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Entry Transition Water Surface Profile Prediction in Supercritical Partially Filled Pipe Flow

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U.S. DEPARTMENT OF COMMERCE, Malcolm Baldrige, *Secretary*
NATIONAL BUREAU OF STANDARDS, Ernest Ambler, *Director*

PREFACE

This report is one of a group documenting National Bureau of Standards (NBS) research and analysis efforts in developing water conservation test methods, models for technical and economic analysis, and strategies for implementation and acceptance of practices. This work is sponsored by the Department of Housing and Urban Development, Office of Policy Development and Research, Building Technology and Standards Division, under HUD Interagency Agreement H-48-78.

SUMMARY

The criteria governing the development of steady partially filled supercritical pipe flow are presented together with the necessary techniques to determine the water surface profile in the pipe entry transition length.

The establishment of full bore flow is predicted for a range of flow rates and pipe design parameters. Based on the water surface profile calculation technique pipe length predictions are presented to avoid the air pressure fluctuations in the drainage system that result from full bore flow establishment.

Tabular data are presented to allow design decisions to be made that link pipe slope, diameter and roughness to the need to avoid full bore flow. A graphical technique is also presented that removes the necessity to interpolate from the tabular data.

The effect of entry geometry loss coefficients is included in the techniques presented.

CONTENTS

LIST OF FIGURES AND TABLES

NOTATION

A	Channel cross sectional area
C	Chezy constant
D	Pipe diameter
E	Specific energy
g	Acceleration due to gravity
h	Flow depth
h_c	Critical flow depth
h_e	Entry flow depth
h_n	Normal flow depth
L	Transition length
m	Hydraulic mean depth
n	Manning coefficient
P	Wetted perimeter
Q	Flow rate
S	Slope of energy grade line
S_o	Channel slope
T	Water surface width in channel
V	Local average velocity
x	Axial flow direction
Z	Elevation channel above some datum
ρ	Fluid density
θ_1	Approach pipe slope
θ_2	Test pipe slope

1. INTRODUCTION

In the design of building drainage systems the maintenance of appliance trap seals is a major criterion. Trap seal depletion may occur as a result of either negative or positive air pressure transients in the drainage pipework. Positive pressures may be generated if the water flow in the system becomes full bore at some downstream location. The most common cause of such a closure of the air passage above the water surface is the flow depth change that accompanies a change in pipe slope. The transition from vertical stack flow to the near horizontal building drain, commonly set at gradients in the range 1/40 to 1/80, results in a rapid depth increase downstream of the slope change that may result in the establishment of local full bore flow. Transition from the entry depth to a greater depth can be erroneously interpreted in experimental observations as an hydraulic jump; the theoretical predictions developed here indicate that a monotonically increasing (smooth) depth change can occur. The conditions under which a hydraulic jump exist are discussed in an earlier study [1].

The design criteria necessary to avoid this condition are set out in this report, together with the necessary computing techniques and design table examples for a range of typical pipe diameters, gradients and flow rates.

2. THEORETICAL CONSIDERATIONS

2.1 STEADY, UNIFORM FLOW IN PARTIALLY FILLED PIPE FLOW

Figure 1 illustrates the force balance equation for steady flow in an open channel or partially filled duct. The common expression of this relationship is known as the Chezy equation where

$$V = C \sqrt{m\, S_o} \qquad (1)$$

m = hydraulic mean depth A/P, m
S_o = sin θ, duct slope
V = mean velocity, m/s
C = Chezy constant.

The value of loss coefficient C was found by Manning to be dependent on hydraulic mean depth and duct surface roughness n. The Manning formula is the simplest of the open channel equations:

$$V = \frac{1}{n} m^{2/3} S_o^{1/2}$$

$$Q = \frac{1}{n} A\, m^{2/3} S_o^{1/2} \qquad (2)$$

where Q is the flow rate m^3/s
A is the flow cross sectional area, m^2

The value of the Manning coefficient, n, varies with pipe or channel material. Chow [2] suggests values in the range 0.009 to 0.020 for materials commonly found in building drainage systems. The utilization of n as a variable with depth can be introduced (in the computer program) for more detailed calculations. The effects of wall accumulations on n as a function of deposited materials is unknown.

Equation 1 effectively determines the flow depth, h, under steady, uniform conditions, only one value of h yielding the values of A and m necessary to satisfy the equation. As this depth is by definition constant downstream, $dh/dx = 0$, it must also be the terminal depth corresponding to the flow terminal velocity at that channel slope.

This depth, h_n, is commonly referred to as the normal depth.

The specific energy of the flow may be defined as

$$E = h + \frac{V^2}{2g} \qquad (3)$$

where h = local flow depth, m
V = local average flow velocity, m/s

Figure 2 illustrates the alternate depths that will satisfy equation (3) and their significance in terms of the flow definition.

From equation (3) and figure 2 it may also be seen that the flow specific energy has a minimum value below which the given flow conditions cannot exist. In a general, non rectangular channel this value may be determined:

$$E = h + \frac{Q^2}{2gA^2}$$

$$\frac{dE}{dh} = 0 = 1 - \frac{Q^2}{gA^3}\frac{dA}{dh} \qquad (4)$$

From figure 3

$$dA = T\,dh \qquad (5)$$

where T is the surface width at any depth, h.

From equations (4) and (5) the minimum value of E will occur at a depth value, h_c, that satisfies the expression

$$1 - Q^2T/gA^3 = 0 \qquad (6)$$

This value of h is referred to as the flow critical depth h_c.

If the normal flow depth h_n exceeds h_c then the terminal flow would be termed subcritical, or tranquil flow. If h_n is less than h_c then the flow is termed rapid or supercritical.

It should be stressed that h_c is independent of pipe slope and pipe surface roughness; while the normal depth is dependent on both. Thus the same volume flow rate in any particular pipe may be rapid or tranquil depending on pipe slope, and similarly the same flow rate in a series of constant diameter pipes will be tranquil or rapid depending on roughness.

Pipes or channels in which rapid flow is normal are termed steep, pipes or channels in which tranquil flow is normal are termed of mild slope.

2.2 ENTRY TRANSITION LENGTH IN PARTIALLY FILLED PIPE FLOW

It will be seen from figure 2 that the flow depth at any point along a partially filled drain is dependent on both flow rate and specific energy. However the only stable depth is that represented by the normal flow equation, (2), thus a transition region may be expected in any partially filled pipe flow when the inlet flow conditions, expressed in terms of Q and E, do not match the normal depth characteristic values.

At the base of a vertical stack it is unlikely that the flow rate and specific energy will match the downstream drain normal depth values. In general the specific energy at the drain inlet will be higher than the normal depth and

flow characteristic specific energy, so that the entry flow depth will be less than the downstream normal depth.

Under these conditions frictional forces acting on the fluid flow result in an increase in flow depth downstream until the flow normal depth is reached. Thus a transition regime may be identified whose length is dependent on the pipe slope, diameter and roughness and the entry flow rate and specific energy. Figure 3 illustrates this transition region. This description is generally true whether the flow downstream is classified as subcritical or supercritical.

For the subcritical flow case, the normal depth to be achieved is greater than the flow critical depth and hence its establishment requires the generation of a hydraulic jump. This topic was dealt with in an earlier report [1].

For the supercritical flow case the depth profile may increase downstream until the normal depth is achieved without the generation of a hydraulic jump, or local flow depth discontinuity.

It is however necessary to distinguish clearly between the generation of local full bore flow due to a hydraulic jump and the observation of full bore flow as a result of a "smooth" transition to normal depth in supercritical flow. Comparison of the normal depth, calculated from equation (2), to the critical depth, as calculated from equation (6), is sufficient to determine whether a jump will occur, or whether it is sufficient to only consider the developing supercritical flow depth profile.

Care should be taken in any literature survey of drainage studies in this area as the term "hydraulic jump" is often used loosely to identify both the true jump condition and the establishment of full bore flow as a result of the supercritical depth transition described above.

In both cases the likelihood of full bore flow is predictable from a comparison of the target normal depth with the pipe diameter.

In the analysis presented steady flow conditions are assumed at a range of flow rates. In practice the entry flow to the drain will follow some flow vs time profile. Thus the establishment of full bore flow will depend on the peak entry flow rate and its attenuation as the inflow surge progresses down the pipe. A study of attenuation in supercritical free surface flow [2] indicates that the effect will be small over the first 5 to 6 m of drain so that it is reasonable to base design tables on the assumption that the entry profile may be represented by a series of increasing steady flow rates. Adjustments for the flow increase to permit adjustment for the series of stepwise increased rates may be made in the integrands of the equations in this report.

In order to provide design data two calculation techniques are required:

(1) Comparison of flow normal depth with both the drain critical depth value to determine the applicable flow regime, and the pipe diameter, to determine whether full bore flow is possible at this combination of flow rate, pipe diameter, gradient and roughness.

(2) Calculation of the water surface profile from the pipe entry downstream to either the establishment of normal depth flow or full bore flow. The necessary equations for (1) above have been established. The calculation of the water surface profile requires the use of gradually varied flow analysis.

2.3 GRADUALLY VARIED FLOW IN PARTIALLY FILLED PIPES

Gradually varied flow is steady non-uniform flow of a special type. The flow parameters are assumed to change slowly, if at all, in the flow direction. The basic assumption in the treatment of this type of flow is that the local head loss at any section is given by the Manning expression, (2), for the identical local flow depth and rate under assumed steady, uniform flow conditions.

Depth profile predictions by numerical integration are based on this assumption, expressed in terms of figure 4 by

$$\frac{d}{dL}\left\{\frac{V^2}{2g} + (Z_o - S_oL) + h\right\} = -\left\{\frac{nQ}{Am^{2/3}}\right\}^2 \qquad (7)$$

where $(Z_o - S_oL)$ is the elevation at distance L along the channel, measured in the downstream direction; S_o is sin Θ, channel bed slope,

hence $$-\frac{V}{g}\frac{dV}{dL} + S_o - \frac{dh}{dL} = \left(\frac{nQ}{Am^{2/3}}\right)^2 \qquad (8)$$

and as, $Q = VA$

$$\frac{dV}{dL}A + V\frac{dA}{dL} = 0$$

and as $\frac{dA}{dh} = T$ from equation 5 it follows that

$$\frac{dV}{dL} = \frac{V}{A}\frac{dA}{dL} = -\frac{VT}{A}\frac{dh}{dL} = -\frac{QT}{A^2}\frac{dh}{dL}$$

and substituting in equation (8) yields

$$\frac{Q^2T}{gA^3}\frac{dh}{dL} + S_o - \frac{dh}{dL} = \left\{\frac{n\,Q}{A\,m^{2/3}}\right\}^2 \qquad (9)$$

$$dL = \left\{\frac{1 - Q^2T/g\,A^3}{S_o - (nQ/Am^{2/3})}\right\} dh$$

or

$$L = \int_{h_o}^{h_1} \frac{1 - Q^2T/gA^3}{S_o - (nQ/Am^{2/3})^2} \, dh \qquad (10)$$

where L is the distance between two known depths h_o, h_1.

Figure 5 illustrates this numerical integration, which may be conveniently achieved by Simpson's rule.

The numerator and denominator of equation (10) will be recognized as the equations determining the critical and normal flow depths in an open channel.

When the term $(1 - Q^2T/gA^3)$ is zero the flow is at critical depth, i.e., there is no change in L for a change in h.

For uniform cross section channels with constant roughness, n, and slope, S_o, the expression (10) becomes solely a function of flow depth h.

In order to numerically evaluate (10) it is necessary to define boundary conditions from which the integration may proceed. It should be stressed that the integration may be carried out either upstream or downstream from a known depth point. This ability is central to the use of this technique to determine the position of a profile continuity, such as a hydraulic jump.

Figure 5 illustrates the control depths used in the prediction of the water surface profiles in the case being investigated, namely the change in slope of an open channel.

If the flow rate Q and specific energy are known at pipe entry, at B, figure 3 then the depth at B may be calculated by choosing the lower depth root of equation (4). In the study reported a range of entry specific energy values for a constant inflow were obtained by considering the entry flow at B to have attained terminal flow conditions in an approach pipe, AB figure 3, set at a range of gradients from 15° to 90°, however this artifice is not strictly necessary as any suitable energy values could have been utilized.

The choice of dh values in the numerical integration is based on the difference between the control depth at entry and the "target" depth, representing the normal flow depth to be achieved downstream.

For the example in figure 5 the dh value is

$$dh = (h_n - h_e)/N \qquad (11)$$

where N is a reasonable number in the range 10-30. Since the change from h_e to h_n can be expected to fall within an order of magnitude and the monotonic change (except for the jump condition) in the function h(L) is not rapid the size of incremental steps can be of the order of unity.

If the normal depth, h_n, exceeds the pipe diameter, D, then the numerical integration is terminated when the predicted flow depth exceeds the pipe diameter value.

2.4 LOSS COEFFICIENTS FOR SLOPE TRANSITIONS IN PARTIALLY FILLED PIPE FLOW

No data could be obtained on the loss coefficients for slope transitions in open channel flow. For this reason the results presented assume no loss at the pipe entry. The computer program as written has been designed to include such a loss coefficient, in the range 0 to 1, should such data become available from a future experimental program. The effect of such a loss would be to increase the flow depth at pipe entry, with a consequent decrease in the kinetic energy term at pipe entry. In turn this would have the effect of generally moving the energy transition upstream towards pipe entry. Experimental work is required as a back up to the computer simulation to clarify this area.

3. CALCULATION TECHNIQUES AND PRESENTATION OF RESULTS

3.1 DETERMINATION OF NORMAL AND CRITICAL DEPTHS

The bisection method was used to solve the equation defining both critical flow depth

$$X = 1 - Q^2T/gA^3$$

and normal flow depth

$$Y = S_o - (n\,Q/Am^{2/3})^2.$$

It may be assumed that both X and Y have zero values for some value of depth h in the range $0 < h < D$ for pipe case or $0 < h < W$ for the square section case.

This initial interval is bisected and h = D/2 or w/2 for the square section) used to evaluate X, Y. If the resulting values are positive then the root is less than the midpoint. The upper limit is then reset equal to the h value just used and the remaining interval bisected. The process repeats until a root is obtained. If the X or Y value had been negative then the root would be greater than the trial h value. In this case the lower limit is reset to the trial h value and incremented with the remaining interval bisected.

Due to the need to include the area depth relationship this solution must be undertaken by an iterative process. The computer time taken depends on the complexity of the area-depth function.

3.2 NUMERICAL INTEGRATION FOR SURFACE PROFILES

The integration of the position vs depth profile

$$L = \int_{h_o}^{h_1} \frac{1 - Q^2T/gA^3}{S_o - (nQ/Am^{2/3})^2}\,dh$$

is achieved by means of Simpson's Rule. Let the integral $X = \int_{h_0}^{h_1} F(h)\,dh$, then if the interval h_1-h_0 is divided into 2 equal increments, the value of X is given by

$$X = \frac{1}{3}\,dh\,[F(h_o) + 4F(h_o + dh) + F(h_o + 2\,dh)]$$

As the integration moves on the length traversed may be accumulated as L = L + X at the completion of each integration.

3.3 PRESENTATION OF RESULTS

The transition profiles for the following cases are presented in tabular form in Appendix I:

Flow rates 2 to 12 ℓ/s, extended to 22 ℓ/s for the 0.15 m diameter pipe case

Pipe diameters: 0.075 m, 0.10 m and 0.15 m

Roughness coefficients: 0.009, 0.012, 0.015, 0.018

Pipe gradients: 1/20, 1/40, 1/60, 1/80

Entry specific energy range simulated by varying the approach pipe slope from 15° to 90°.

In addition to tabular data, an alternative graphical technique is presented.

3.4 INPUT DATA CHOICE

As far as possible the choice of input test conditions was governed by the range of values likely to be found in drainage systems. The pipe diameters chosen, 0.075, 0.10 and 0.15 conform to this criterion as do the pipe gradients used for all test cases, 1/40 to 1/80. The choice of pipe roughness or Manning coefficient was more difficult, however values in the range 0.009 to 0.015 are recommended in many texts, i.e. Jaeger [3] and Chow [4].

Losses at the change of slope that produces the conditions conducive to full bore flow have been ignored in this treatment. No available data on open channel transition loss coefficients for partially filled pipes or channels could be obtained. The program is capable of dealing with transition losses however via an input data control variable provided the loss can be expressed as a factor, 0 to 1.0, of the specific energy of the flow at pipe entry.

4. DISCUSSION OF RESULTS

The water surface profile integration downstream from pipe entry is illustrated by figures 6 and 7. It will be seen that the transition length, or the distance to full bore flow or normal depth, whichever is less, depends on both the flow rate and entry specific energy and hence any simplified prediction technique would have to include both these parameters.

The determination of whether or not full bore flow will occur at any particular combination of flow, Q, roughness, n, and pipe slope, S_o, is rather simpler, depending on a comparison of normal depth to pipe diameter.

Figure 8 presents the normal depth to pipe diameter ratio as a function of a term $nQ/S_o^{1/2}$ that may be seen to determine normal depth from the Manning expression, equation (2). It will be seen that the curves for each of the three pipe diameters tend to become linear at the higher values of h_n/D. Thus a general equation may be proposed to indicate whether full bore flow is achievable, from figure 8,

$$\frac{h_n}{D} = 0.14 + 0.0018\, D^{-2.67} \cdot \frac{nQ}{S_o^{1/2}} \qquad (12)$$

Once the establishment of full bore flow has been predicted it becomes necessary to determine whether this will occur within the system pipe length. The tables presented in Appendix 1 allow this calculation provided that the inflow rate and specific energy are known together with pipe slope, roughness and diameter.

Obviously if the transition length predicted is less than the required pipe length then design alternatives would include an increase in pipe slope, an increase in pipe diameter or the use of a smoother pipe, although it is recognized that this last alternative is unlikely to be employed.

The use of such tabular data is considered practical, however a graphical technique would have advantages in terms of the appreciation of effect of rapid design changes.

The problem to be solved here is the dependence of transition length on entry energy, however this may be bypassed if the entry depth is calculated.

Figure 9 presents the entry depth for any flow rate and specific energy combination for the three pipe diameters condensed in the form

$$h_e/D = f(Q, E)$$

$$(h_e/D)/Q = f_1(E)$$

Thus for any Q and E values the entry depth h_e may be read off figure 9.

It was found that the transition length at any pipe roughness, gradient, inflow rate and specific energy could be expressed in terms of

$$L/D = f(h_n/D - h_e/D)$$

as illustrated in figure 10.

For example, for a given flow rate the entry depth will decrease as the entry specific energy increases. Hence the depth change to be achieved to either full bore flow or normal depth increases as the entry energy rises. Therefore it would be reasonable to expect that the transition length would increase as the entry depth decreased, as shown in figure 10.

The curves in figure 10 apply to the specified one pipe diameter at one pipe slope at a range of pipe roughness coefficients. Obviously such curves may be generated from the data presented in appendix 1 for all the test cases.

It will be noted that individual points are plotted in figure 10 in the manner normal for test results and display a degree of scatter. This is due to the use of either pipe diameter or normal depth as the depth downstream target, whichever is the smaller value. This leads to a slight incompatibility between transition lengths to either D or h_n. However this scatter of the order of 2 to 3 percent and is well within the other uncertainties in the design of drainage systems, so that this technique may be proposed as a rapid visual method of determining the effect of design changes.

The tabular data presented in appendix 1 may be utilized if the entry flow rate and specific energy are known. Referring to table 1, reproduced from appendix 1, it will be seen that it will be necessary to employ an interpolation technique to determine the transition length if the flow entry rate and specific energy do not match the values given. The curves based on the tabular data presented above indicate that a simple linear interpolation would be sufficient. The format of the data, table 1, could be simplified as the approach pipe slope is, as mentioned, only included as a convenient method of determining a range in inflow specific energies.

Similarly the data could be rearranged in terms of constant inflow rate blocks instead of the constant approach pipe slope utilized in appendix 1 and table 1.

The data presented has been based on inflow rate and specific energy and does not include an entry loss coefficient. In practice the form of the entry junction from, for example, a vertical stack to the building drain would lead to a junction loss coefficient that would appear, for any given flow rate, as a reduced specific energy.

Although this loss coefficient is not included in the presented data, it is automatically accounted for in the prediction method outlined above. A reduction in specific energy for any flow rate effectively increases the entry depth, figure 9, and hence reduces the transition length, figure 10, for any one set of pipe design parameters.

In the absence of published data on such loss coefficients, experimental work is suggested to fill this gap and the inclusion of an estimated loss coefficient is recommended in the application of the presented data.

5. CONCLUSIONS

In supercritical flow in a partially filled pipe a transition region may be identified at the pipe entry that allows the flow depth to increase to that compatible with the flow rate and pipe parameters (slope, roughness, diameter, etc.).

This transition may lead to the establishment of full bore flow if the pipe exceeds the necessary transition length at flow rates where the normal depth, as predicted by Mannings equation, exceeds the pipe diameter.

This study has identified the conditions necessary for full bore flow and has determined the transition lengths at a range of flow rates and pipe design parameters compatible with current drainage design.

It is stressed that the design data presented is based on entry flow and specific energy. Although no entry loss coefficient has been included, this effect is automatically accounted for in the design curves presented as an entry loss would merely reduce the flow specific energy at entry and would not affect the validity of predictions based on the data presented.

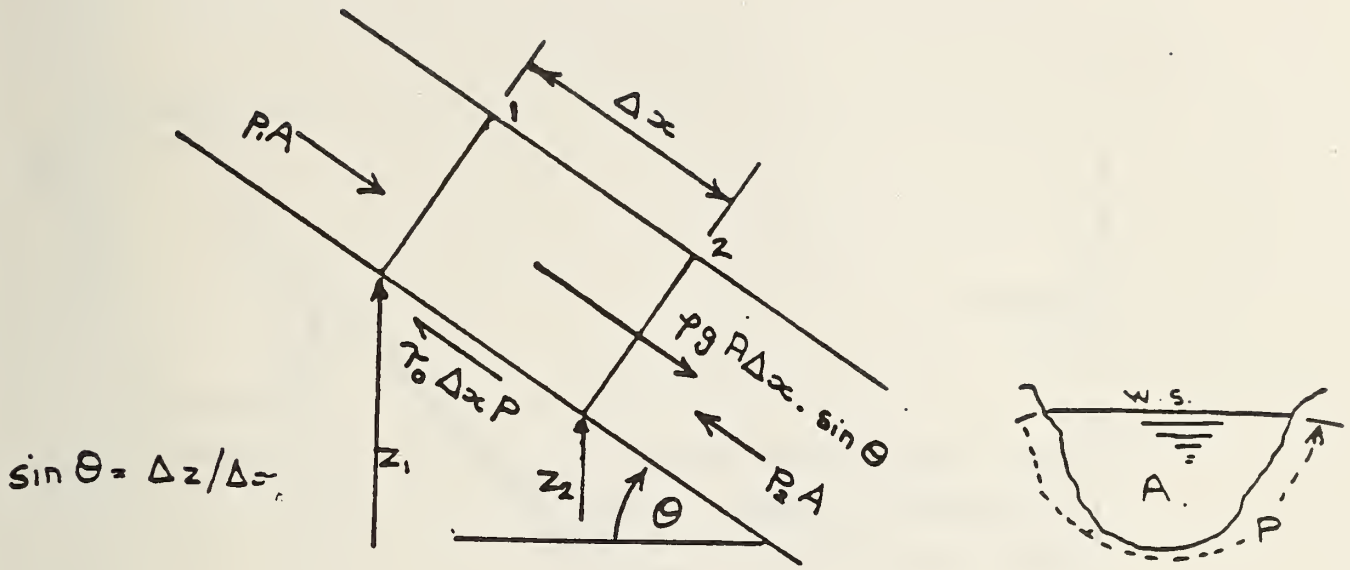
6. REFERENCES

1. Swaffield, J. A., Prediction of the Hydraulic Jump Location Following a Change of Slope in Partially Filled Pipe Flow, NBS Report, August 1980.

2. Swaffield, J. A., Application of the Method of Characteristics to Predict Attenuation in Unsteady Partially Filled Pipe Flow, NBS Report, October 1980.

3. Jaeger, C., Engineering Fluid Mechanics, Blackie and Sons, London, 1956.

4. Chow, V. T., Open Channel Hydraulics, McGraw Hill, 1970.



From energy equation 1 - 2

$$\text{Losses} = h_f = \frac{p_1 - p_2}{\rho g} + z_1 - z_2$$

as $V_1 = V_2$; steady, uniform flow.

From momentum equation down slope

$$(p_1 - p_2)A + \rho g A \Delta x \sin\theta - \tau_0 \Delta x P = 0$$

as $dV/dt = 0$; steady flow.

$$\therefore \quad \frac{p_1 - p_2}{\rho g} + \Delta z = \tau_0 \frac{\Delta x\, P}{\rho g A} = h_f$$

For turbulent flow $\tau_0 = f \frac{1}{2} \rho V^2$

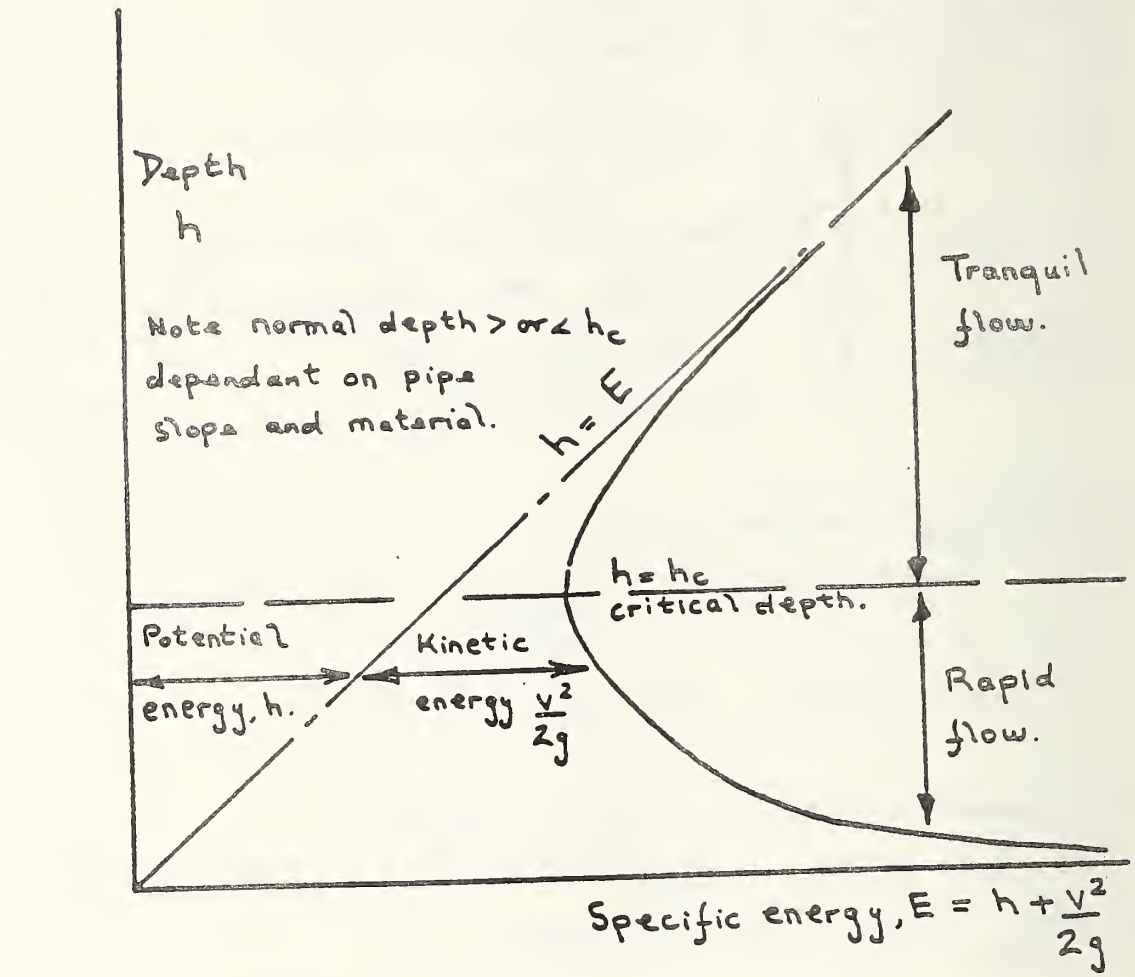
$$h_f = f \frac{\Delta x\, V^2}{2 g m}, \quad V = C\sqrt{m S_0}$$

$S_0 = \sin\theta$

$m = A/P$

C = constant

Figure 1. Derivation of Chezy's equation for free surface flow



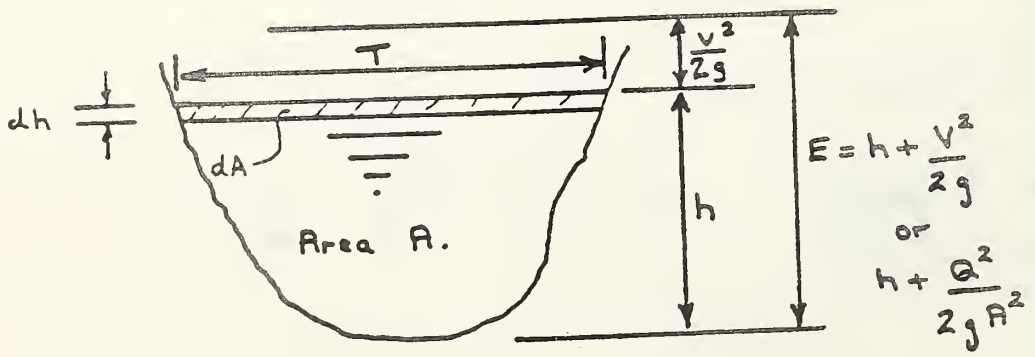
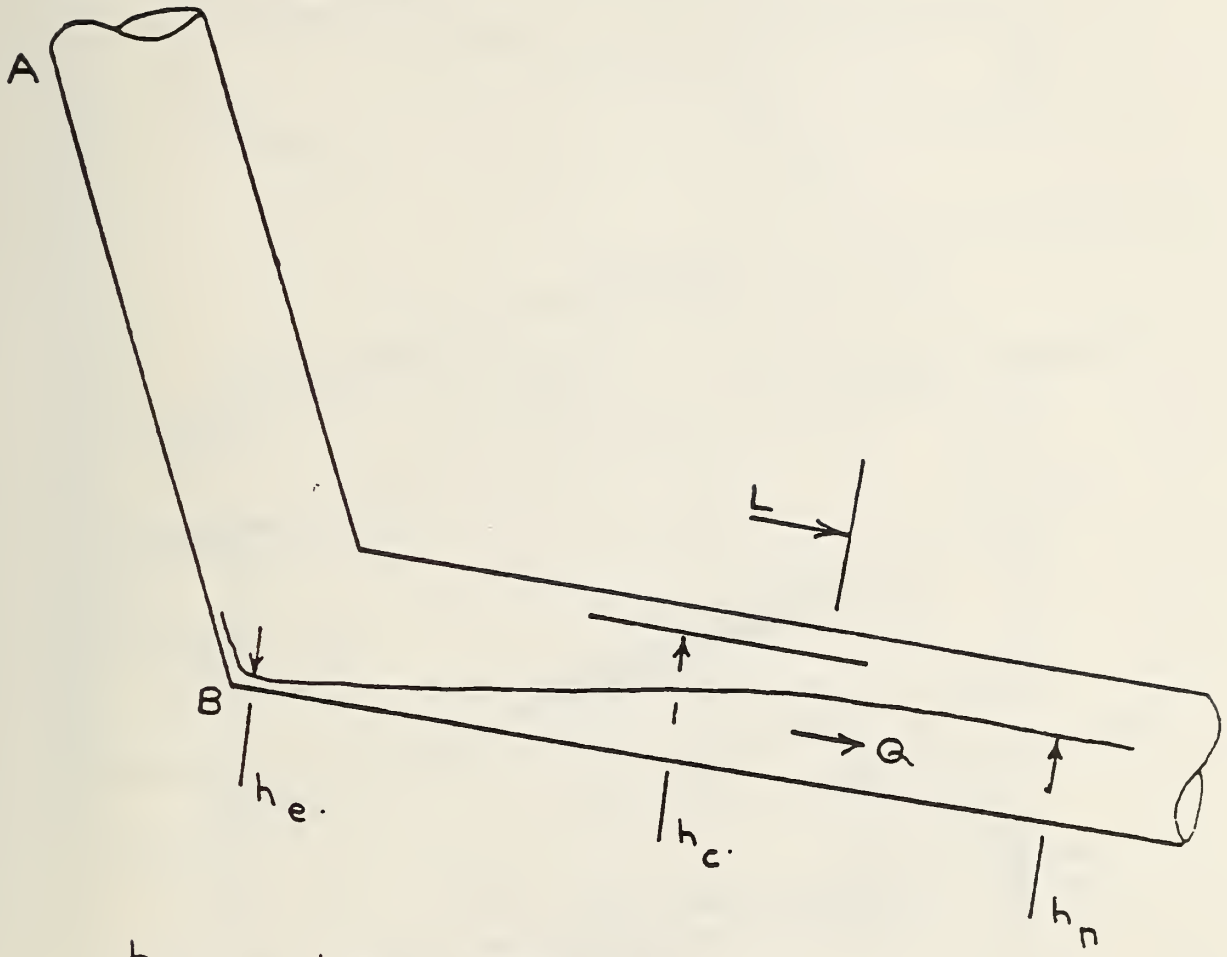


Figure 2. Relationship between flow specific energy and flow depth



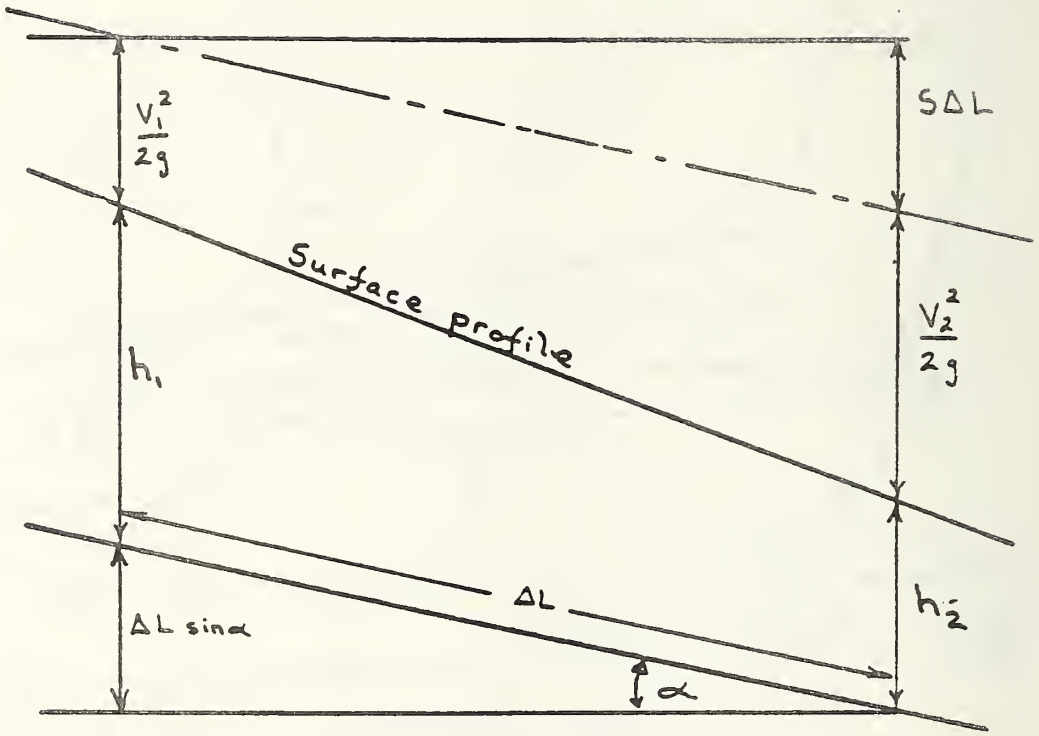
$h_n < h_c$, flow supercritical, no hydraulic jump forms.

$h_e = f(Q, E)$, $E = h_e + V_e^2/2g$

Transition length $L = f(h_e, h_n)$

Note transition length taken as L value for $h = 0.975\, h_n$.

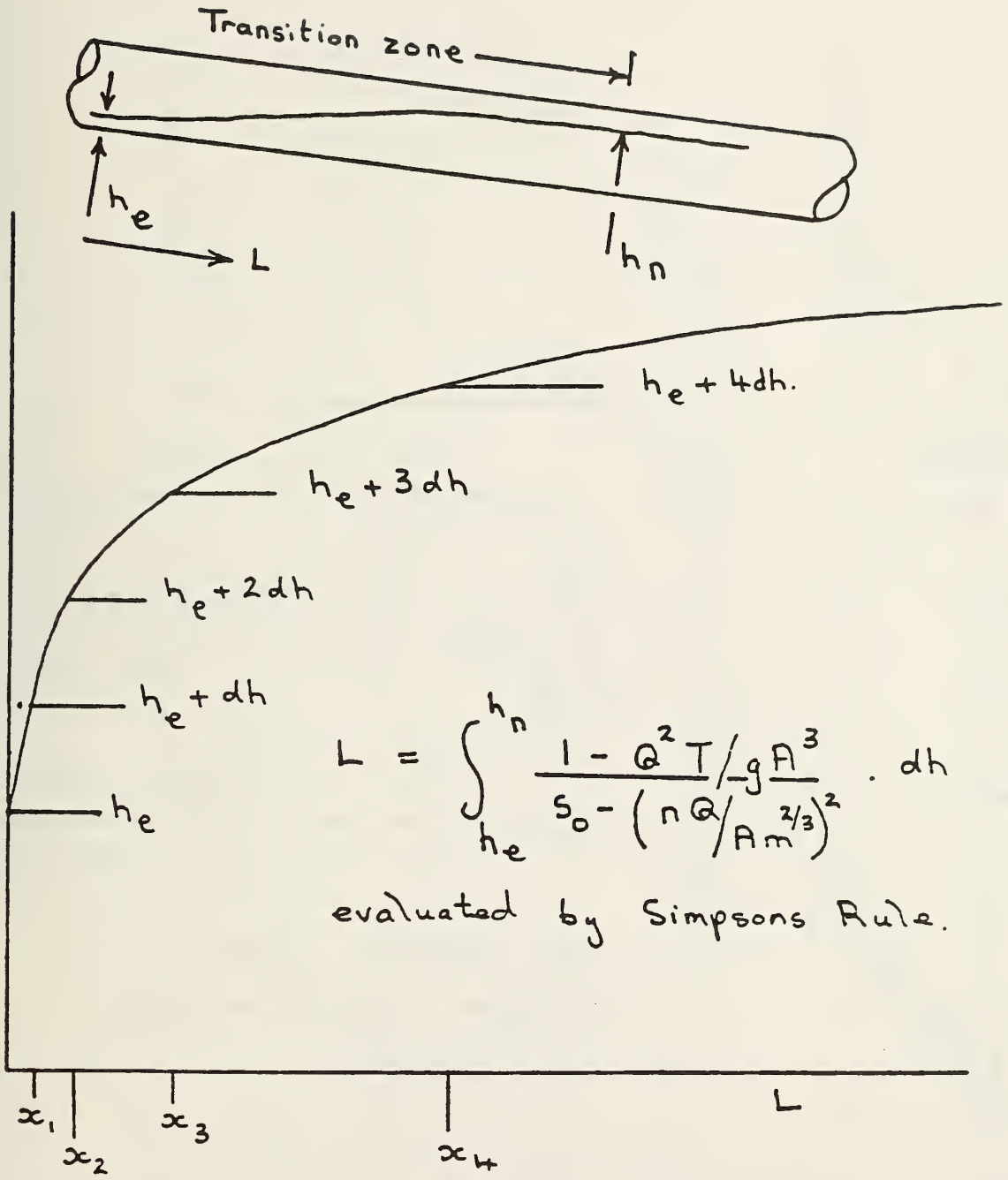
Figure 3. Transition length downstream of a pipe slope change in partially filled pipe flow



Gradually varied flow, analysis based on head loss at any section being equal to Manning loss prediction, where

$$S = -\frac{\Delta E}{\Delta L} = \left(\frac{nQ}{A\, m^{2/3}}\right)^2$$

Figure 4. Basis of gradually varied flow analysis



Note (i) ΔL increases as L increases

(ii) water surface profile approaches normal depth as shown only in supercritical flow

Figure 5. Schematic representation of numerical integration to determine water surface profile

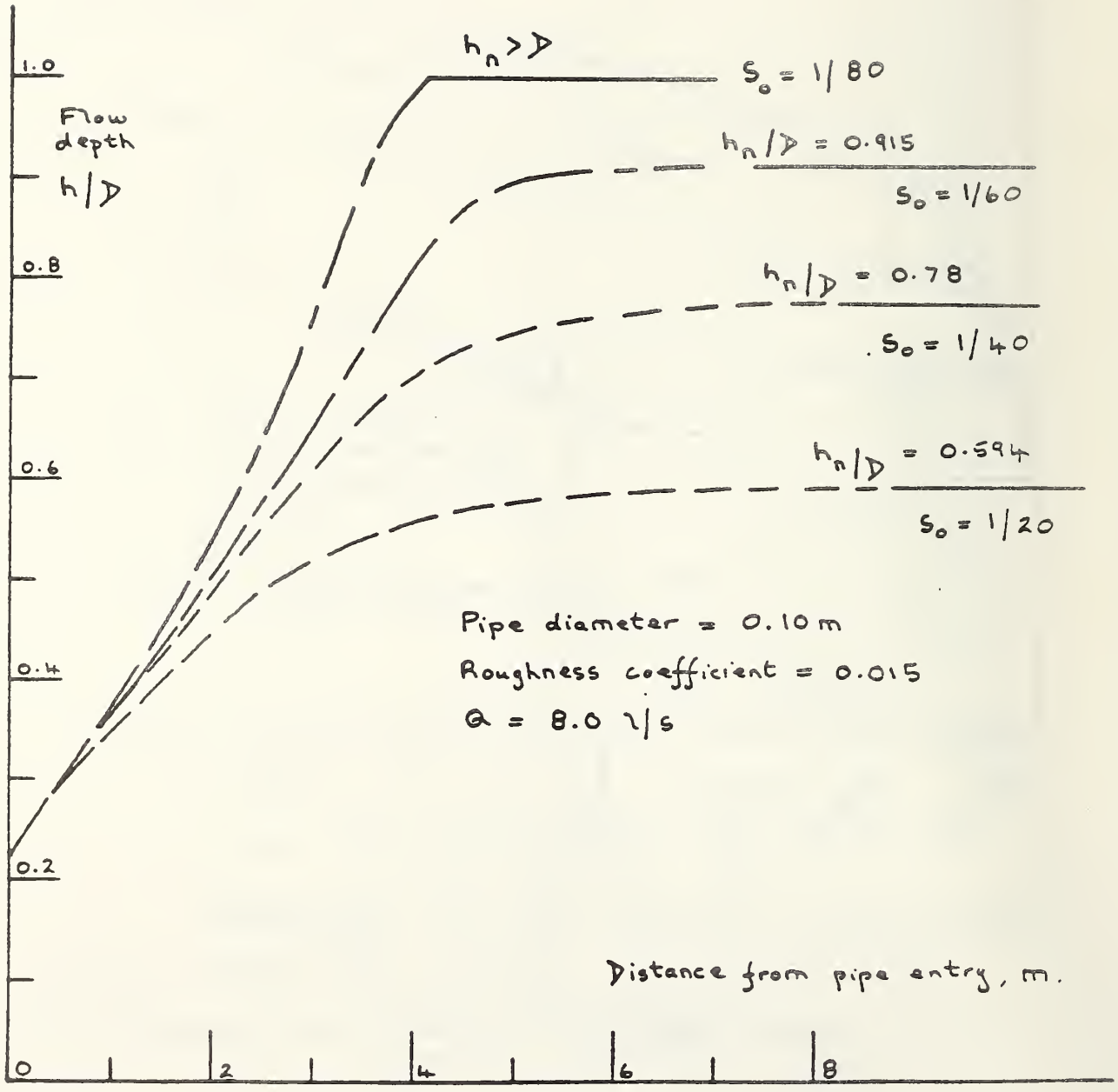


Figure 6. Water surface profiles for a range of pipe gradients, illustrating increase in transition length as pipe slope is increased

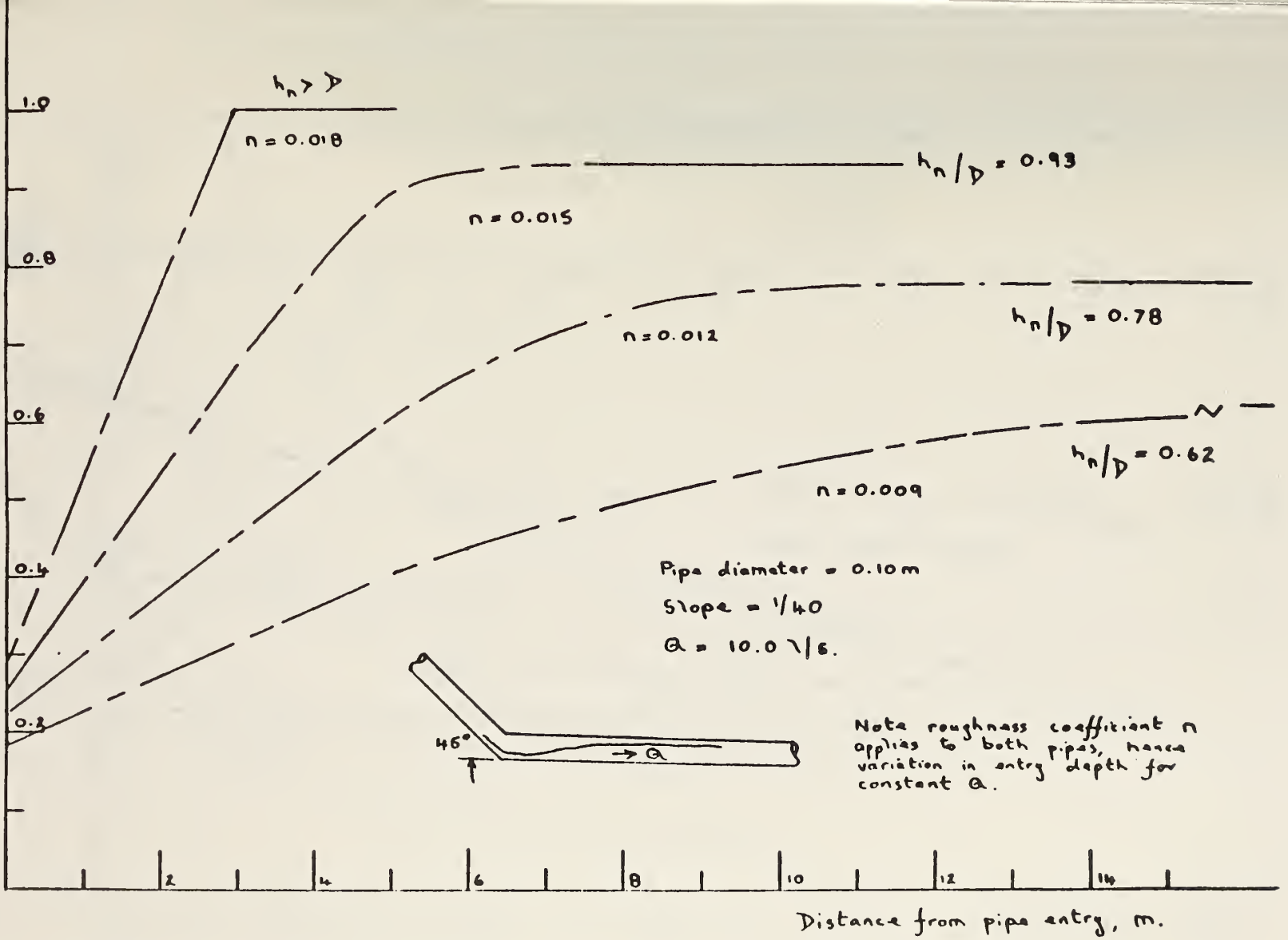


Figure 7. Water surface profile for a range of pipe roughness values, illustrating increased transition length as pipe roughness is decreased

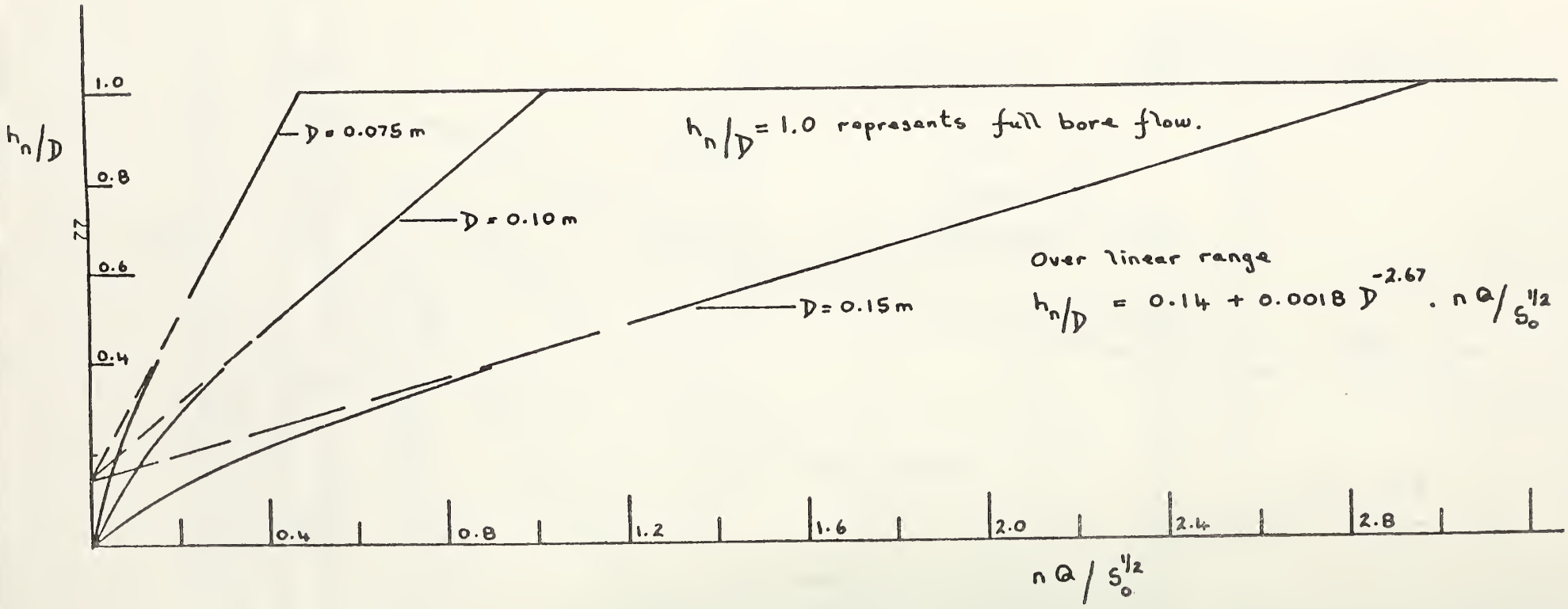


Figure 8. Flow normal depth as a function of pipe and flow parameters for a range of pipe diameters.

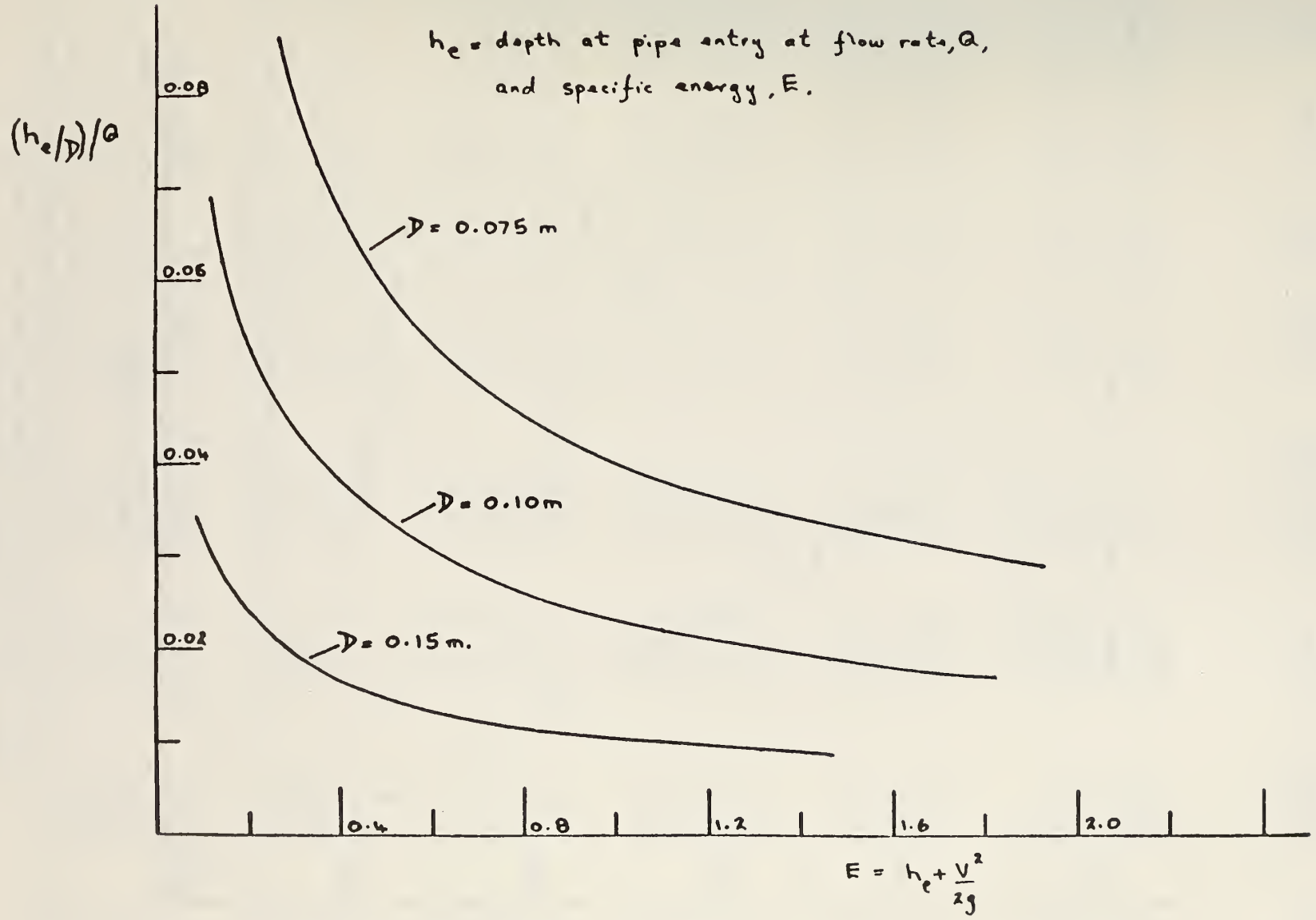


Figure 9. Entry depth as a function of flow rate and entry specific energy

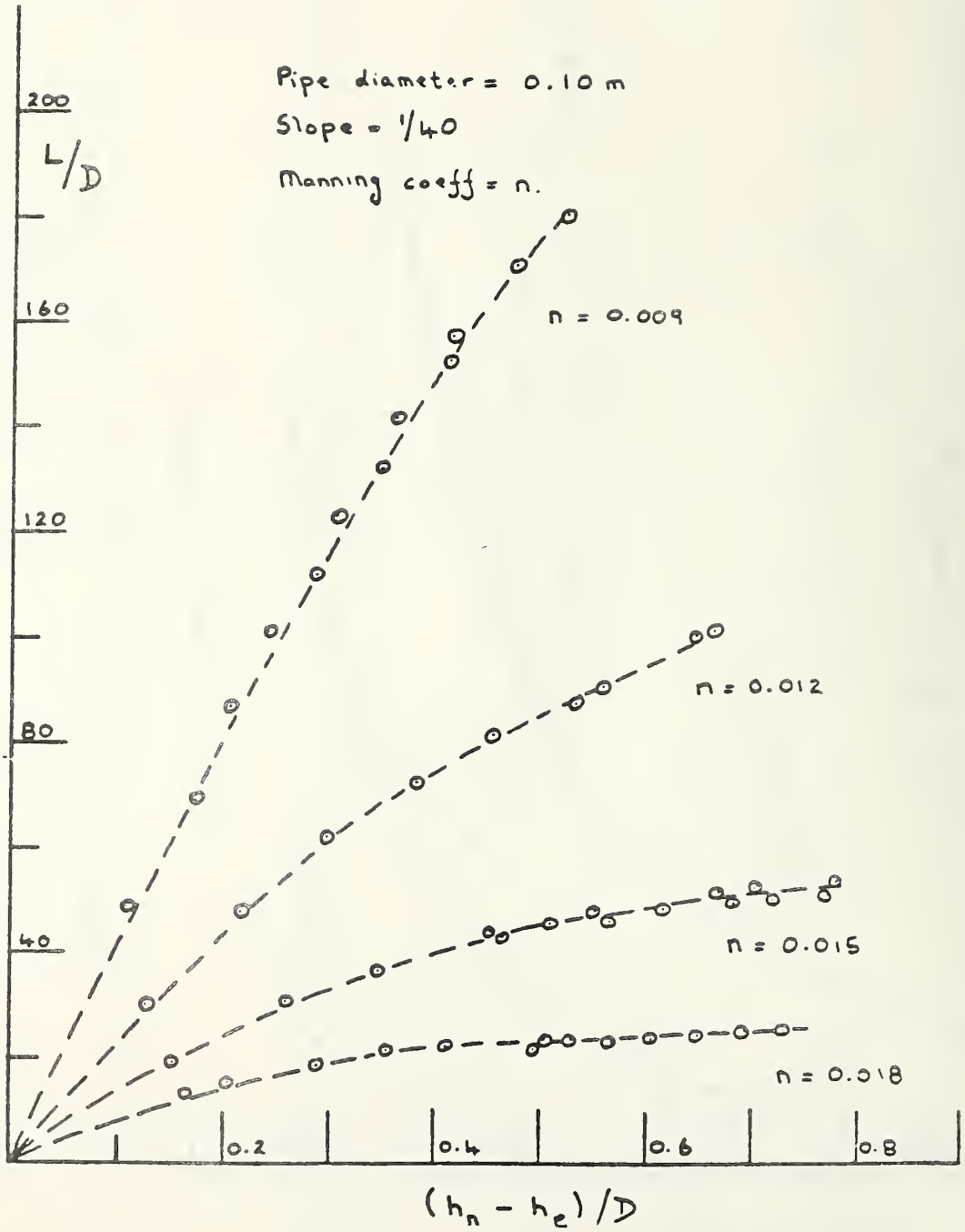


Figure 10. Transition length as a function of depth change from entry to normal depth, note that flow rate and entry energy are subsumed in the depth change term

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN ENTRY RATIO	FLOW DEPTH M/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPL LENGTH TO NORMAL DEPTH. L/D.
2.00	0.075	0.0090	0.2566	0.0500	0.1493		0.3003	0.2605	55.3110
4.00	0.075	0.0090	0.2566	0.0500	0.2384		0.4714	0.4250	90.4655
6.00	0.075	0.0090	0.2566	0.0500	0.3167		0.6021	0.5796	119.9573
8.00	0.075	0.0090	0.2566	0.0500	0.3594		0.7091	0.7241	136.7733
10.00	0.075	0.0090	0.2566	0.0500	0.4567		0.7999	0.8647	154.6711
12.00	0.075	0.0090	0.2566	0.0500	0.5259		0.8782	1.0000	170.8372
2.00	0.075	0.0090	0.5000	0.0500	0.1204		0.4534	0.2605	61.7167
4.00	0.075	0.0090	0.5000	0.0500	0.1906		0.7241	0.4250	100.8709
6.00	0.075	0.0090	0.5000	0.0500	0.2512		0.9377	0.5796	124.5654
8.00	0.075	0.0090	0.5000	0.0500	0.3074		1.1143	0.7241	153.0399
10.00	0.075	0.0090	0.5000	0.0500	0.3606		1.2659	0.8647	173.2925
12.00	0.075	0.0090	0.5000	0.0500	0.4114		1.4015	1.0000	210.7071
2.00	0.075	0.0090	0.7070	0.0500	0.1076		0.5646	0.2605	64.2399
4.00	0.075	0.0090	0.7070	0.0500	0.1696		0.9092	0.4250	105.0192
6.00	0.075	0.0090	0.7070	0.0500	0.2230		1.1825	0.5796	129.6715
8.00	0.075	0.0090	0.7070	0.0500	0.2722		1.4117	0.7241	159.7544
10.00	0.075	0.0090	0.7070	0.0500	0.3186		1.6106	0.8647	181.3117
12.00	0.075	0.0090	0.7070	0.0500	0.3631		1.7872	1.0000	220.0757
2.00	0.075	0.0090	0.8660	0.0500	0.1008		0.6421	0.2605	65.5255
4.00	0.075	0.0090	0.8660	0.0500	0.1588		1.0369	0.4250	107.1155
6.00	0.075	0.0090	0.8660	0.0500	0.2091		1.3543	0.5796	137.9052
8.00	0.075	0.0090	0.8660	0.0500	0.2537		1.6213	0.7241	165.2255
10.00	0.075	0.0090	0.8660	0.0500	0.2966		1.8530	0.8647	188.8270
12.00	0.075	0.0090	0.8660	0.0500	0.3372		2.0654	1.0000	232.8050
2.00	0.075	0.0090	0.9659	0.0500	0.0974		0.6672	0.2605	66.1533
4.00	0.075	0.0090	0.9659	0.0500	0.1530		1.1131	0.4250	108.1747
6.00	0.075	0.0090	0.9659	0.0500	0.2006		1.4567	0.5796	139.3307
8.00	0.075	0.0090	0.9659	0.0500	0.2444		1.7445	0.7241	164.4923
10.00	0.075	0.0090	0.9659	0.0500	0.2854		1.9990	0.8647	187.2756
12.00	0.075	0.0090	0.9659	0.0500	0.3245		2.2277	1.0000	230.8107
2.00	0.075	0.0090	0.9962	0.0500	0.0964		0.7013	0.2605	66.3314
4.00	0.075	0.0090	0.9962	0.0500	0.1512		1.1361	0.4250	108.4443
6.00	0.075	0.0090	0.9962	0.0500	0.1984		1.4857	0.5796	139.7455
8.00	0.075	0.0090	0.9962	0.0500	0.2416		1.7547	0.7241	165.4794
10.00	0.075	0.0090	0.9962	0.0500	0.2820		2.0479	0.8647	187.6113
12.00	0.075	0.0090	0.9962	0.0500	0.3210		2.2740	1.0000	237.0351

Table 1. Typical Tabular Data for 0.10 m Diameter Pipe

APPENDIX 1

TABULAR DATA RELATING FLOW NORMAL DEPTH AND TRANSITION LENGTH TO FLOW AND PIPE PARAMETERS

Cases included:

D = 0.075 m, Q = 2 - 12 ℓ/s, n = 0.009 - 0.018
D = 0.10 m, Q = 2 - 12 ℓ/s, n = 0.009 - 0.018
D = 0.15 m, Q = 2 - 12 ℓ/s, n = 0.009 - 0.018
D = 0.15 m, Q = 14 - 22 ℓ/s, n = 0.009 - 0.018

$D = 0.075$

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO M/D.	ENTRY ENERGY M.	NORMAL DEPTH M/D.	PIPE LENGTH TI NORMAL DEPTH. L/D.
2.00	0.075	0.0090	0.2566	0.0500	0.1493	0.3003	0.2605	55.3110
4.00	0.075	0.0090	0.2566	0.0500	0.2384	0.4714	0.4230	90.4685
6.00	0.075	0.0090	0.2566	0.0500	0.3167	0.6021	0.5796	115.9573
8.00	0.075	0.0090	0.2566	0.0500	0.3894	0.7091	0.7241	136.7733
10.00	0.075	0.0090	0.2566	0.0500	0.4567	0.7999	0.8647	154.6711
12.00	0.075	0.0090	0.2566	0.0500	0.5259	0.8782	1.0000	170.8342
2.00	0.075	0.0090	0.5000	0.0500	0.1204	0.4534	0.2605	61.7167
4.00	0.075	0.0090	0.5000	0.0500	0.1906	0.7241	0.4230	100.8709
6.00	0.075	0.0090	0.5000	0.0500	0.2512	0.9377	0.5796	129.5654
8.00	0.075	0.0090	0.5000	0.0500	0.3074	1.1143	0.7241	153.0699
10.00	0.075	0.0090	0.5000	0.0500	0.3606	1.2659	0.8647	173.2926
12.00	0.075	0.0090	0.5000	0.0500	0.4114	1.4015	1.0000	210.7071
2.00	0.075	0.0090	0.7070	0.0500	0.1076	0.5646	0.2605	64.2399
4.00	0.075	0.0090	0.7070	0.0500	0.1696	0.9092	0.4230	105.0192
6.00	0.075	0.0090	0.7070	0.0500	0.2230	1.1826	0.5796	135.0716
8.00	0.075	0.0090	0.7070	0.0500	0.2722	1.4117	0.7241	159.7544
10.00	0.075	0.0090	0.7070	0.0500	0.3186	1.6108	0.8647	181.0117
12.00	0.075	0.0090	0.7070	0.0500	0.3630	1.7872	1.0000	225.0757
2.00	0.075	0.0090	0.8660	0.0500	0.1008	0.6421	0.2605	65.5256
4.00	0.075	0.0090	0.8660	0.0500	0.1586	1.0369	0.4230	107.1185
6.00	0.075	0.0090	0.8660	0.0500	0.2091	1.3543	0.5796	137.9052
8.00	0.075	0.0090	0.8660	0.0500	0.2537	1.6213	0.7241	163.2255
10.00	0.075	0.0090	0.8660	0.0500	0.2966	1.8530	0.8647	185.0276
12.00	0.075	0.0090	0.8660	0.0500	0.3372	2.0659	1.0000	232.8050
2.00	0.075	0.0090	0.9659	0.0500	0.0974	0.6872	0.2605	66.1538
4.00	0.075	0.0090	0.9659	0.0500	0.1530	1.1131	0.4230	108.1747
6.00	0.075	0.0090	0.9659	0.0500	0.2006	1.4567	0.5796	139.3307
8.00	0.075	0.0090	0.9659	0.0500	0.2444	1.7445	0.7241	164.9523
10.00	0.075	0.0090	0.9659	0.0500	0.2854	1.9990	0.8647	187.3756
12.00	0.075	0.0090	0.9659	0.0500	0.3245	2.2277	1.0000	236.6107
2.00	0.075	0.0090	0.9962	0.0500	0.0964	0.7010	0.2605	66.3314
4.00	0.075	0.0090	0.9962	0.0500	0.1512	1.1381	0.4230	108.4443
6.00	0.075	0.0090	0.9962	0.0500	0.1984	1.4887	0.5796	139.7455
8.00	0.075	0.0090	0.9962	0.0500	0.2416	1.7847	0.7241	165.4743
10.00	0.075	0.0090	0.9962	0.0500	0.2820	2.0470	0.8647	187.9773
12.00	0.075	0.0090	0.9962	0.0500	0.3210	2.2746	1.0000	237.5357

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH TO NORMAL DEPTH. L/D.
2.00	0.075	0.0090	0.2588	0.0250	0.1493	0.3003	0.3328	74.7487
4.00	0.075	0.0090	0.2588	0.0250	0.2384	0.4714	0.5542	116.5883
6.00	0.075	0.0090	0.2588	0.0250	0.3167	0.6021	0.7593	147.3991
8.00	0.075	0.0090	0.2588	0.0250	0.3894	0.7091	0.9556	166.7624
10.00	0.075	0.0090	0.2588	0.0250	0.4587	0.7999	1.0000	186.4435
12.00	0.075	0.0090	0.2588	0.0250	0.5259	0.8782	1.0000	82.4533
2.00	0.075	0.0090	0.5000	0.0250	0.1204	0.4534	0.3328	80.1538
4.00	0.075	0.0090	0.5000	0.0250	0.1906	0.7241	0.5542	125.5291
6.00	0.075	0.0090	0.5000	0.0250	0.2512	0.9377	0.7593	159.2294
8.00	0.075	0.0090	0.5000	0.0250	0.3074	1.1143	0.9556	183.1312
10.00	0.075	0.0090	0.5000	0.0250	0.3606	1.2659	1.0000	125.8948
12.00	0.075	0.0090	0.5000	0.0250	0.4114	1.4015	1.0000	101.9159
2.00	0.075	0.0090	0.7070	0.0250	0.1076	0.5646	0.3328	82.4540
4.00	0.075	0.0090	0.7070	0.0250	0.1696	0.9092	0.5542	129.3949
6.00	0.075	0.0090	0.7070	0.0250	0.2230	1.1826	0.7593	164.3577
8.00	0.075	0.0090	0.7070	0.0250	0.2722	1.4117	0.9556	189.4262
10.00	0.075	0.0090	0.7070	0.0250	0.3186	1.6108	1.0000	133.7221
12.00	0.075	0.0090	0.7070	0.0250	0.3630	1.7872	1.0000	110.5250
2.00	0.075	0.0090	0.8660	0.0250	0.1008	0.6421	0.3328	83.6575
4.00	0.075	0.0090	0.8660	0.0250	0.1586	1.0369	0.5542	131.4030
6.00	0.075	0.0090	0.8660	0.0250	0.2061	1.3543	0.7593	167.0721
8.00	0.075	0.0090	0.8660	0.0250	0.2537	1.6213	0.9556	192.7849
10.00	0.075	0.0090	0.8660	0.0250	0.2966	1.8530	1.0000	137.8971
12.00	0.075	0.0090	0.8660	0.0250	0.3372	2.0659	1.0000	115.4011
2.00	0.075	0.0090	0.9659	0.0250	0.0974	0.6872	0.3328	84.2522
4.00	0.075	0.0090	0.9659	0.0250	0.1530	1.1131	0.5542	132.4250
6.00	0.075	0.0090	0.9659	0.0250	0.2006	1.4567	0.7593	168.4518
8.00	0.075	0.0090	0.9659	0.0250	0.2444	1.7445	0.9556	194.4705
10.00	0.075	0.0090	0.9659	0.0250	0.2854	1.9990	1.0000	140.0917
12.00	0.075	0.0090	0.9659	0.0250	0.3245	2.2277	1.0000	117.7731
2.00	0.075	0.0090	0.9962	0.0250	0.0964	0.7010	0.3328	84.4212
4.00	0.075	0.0090	0.9962	0.0250	0.1512	1.1381	0.5542	132.7360
6.00	0.075	0.0090	0.9962	0.0250	0.1984	1.4887	0.7593	168.8524
8.00	0.075	0.0090	0.9962	0.0250	0.2416	1.7847	0.9556	194.9522
10.00	0.075	0.0090	0.9962	0.0250	0.2820	2.0470	1.0000	140.7102
12.00	0.075	0.0090	0.9962	0.0250	0.3210	2.2746	1.0000	118.4150

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN ENTRY RATIO	FLOW DEPTH H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH TO NORMAL DEPTH. L/D.
2.00	0.075	0.0090	0.2588	0.0167	0.1493		0.3003	0.3850	84.0454
4.00	0.075	0.0090	0.2588	0.0167	0.2384		0.4714	0.6470	126.7449
6.00	0.075	0.0090	0.2588	0.0167	0.3167		0.6021	0.8921	155.8694
8.00	0.075	0.0090	0.2588	0.0167	0.3894		0.7091	1.0000	116.6959
10.00	0.075	0.0090	0.2588	0.0167	0.4587		0.7999	1.0000	90.0043
12.00	0.075	0.0090	0.2588	0.0167	0.5259		0.8782	1.0000	73.6458
2.00	0.075	0.0090	0.5000	0.0167	0.1204		0.4534	0.3850	89.2367
4.00	0.075	0.0090	0.5000	0.0167	0.1906		0.7241	0.6470	135.4462
6.00	0.075	0.0090	0.5000	0.0167	0.2512		0.9377	0.8921	167.4643
8.00	0.075	0.0090	0.5000	0.0167	0.3074		1.1143	1.0000	131.7240
10.00	0.075	0.0090	0.5000	0.0167	0.3606		1.2659	1.0000	106.9604
12.00	0.075	0.0090	0.5000	0.0167	0.4114		1.4015	1.0000	92.6297
2.00	0.075	0.0090	0.7070	0.0167	0.1076		0.5646	0.3850	91.4971
4.00	0.075	0.0090	0.7070	0.0167	0.1696		0.9092	0.6470	139.2914
6.00	0.075	0.0090	0.7070	0.0167	0.2230		1.1826	0.8921	172.1791
8.00	0.075	0.0090	0.7070	0.0167	0.2722		1.4117	1.0000	136.3745
10.00	0.075	0.0090	0.7070	0.0167	0.3186		1.6108	1.0000	114.6516
12.00	0.075	0.0090	0.7070	0.0167	0.3630		1.7872	1.0000	101.2050
2.00	0.075	0.0090	0.8660	0.0167	0.1008		0.6421	0.3850	92.6928
4.00	0.075	0.0090	0.8660	0.0167	0.1586		1.0369	0.6470	147.0282
6.00	0.075	0.0090	0.8660	0.0167	0.2081		1.3543	0.8921	178.9551
8.00	0.075	0.0090	0.8660	0.0167	0.2537		1.6213	1.0000	141.9461
10.00	0.075	0.0090	0.8660	0.0167	0.2966		1.8530	1.0000	118.7656
12.00	0.075	0.0090	0.8660	0.0167	0.3372		2.0659	1.0000	105.9259
2.00	0.075	0.0090	0.9659	0.0167	0.0974		0.6872	0.3850	93.2647
4.00	0.075	0.0090	0.9659	0.0167	0.1530		1.1131	0.6470	155.7259
6.00	0.075	0.0090	0.9659	0.0167	0.2006		1.4567	0.8921	170.3251
8.00	0.075	0.0090	0.9659	0.0167	0.2444		1.7445	1.0000	143.7465
10.00	0.075	0.0090	0.9659	0.0167	0.2854		1.9990	1.0000	120.8922
12.00	0.075	0.0090	0.9659	0.0167	0.3245		2.2277	1.0000	108.2743
2.00	0.075	0.0090	0.9962	0.0167	0.0964		0.7010	0.3850	93.3151
4.00	0.075	0.0090	0.9962	0.0167	0.1512		1.1381	0.6470	156.4171
6.00	0.075	0.0090	0.9962	0.0167	0.1984		1.4887	0.8921	170.1441
8.00	0.075	0.0090	0.9962	0.0167	0.2416		1.7847	1.0000	144.2933
10.00	0.075	0.0090	0.9962	0.0167	0.2820		2.0470	1.0000	121.5425
12.00	0.075	0.0090	0.9962	0.0167	0.3210		2.2746	1.0000	108.9192

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY RATIO	DEPTH M/D.	ENTRY ENERGY M.	NORMAL DEPTH M/D.	PIPE LENGTH TO NORMAL DEPTH. L/D.
2.00	0.075	0.0090	0.2588	0.0125	0.1493		0.3003	0.4280	87.8675
4.00	0.075	0.0090	0.2588	0.0125	0.2364		0.4714	0.7241	126.2535
6.00	0.075	0.0090	0.2588	0.0125	0.3167		0.6021	1.0000	165.2457
8.00	0.075	0.0090	0.2588	0.0125	0.3894		0.7091	1.0000	101.5207
10.00	0.075	0.0090	0.2588	0.0125	0.4537		0.7999	1.0000	83.6238
12.00	0.075	0.0090	0.2588	0.0125	0.5259		0.8782	1.0000	70.0330
2.00	0.075	0.0090	0.5000	0.0125	0.1204		0.4534	0.4280	93.0496
4.00	0.075	0.0090	0.5000	0.0125	0.1906		0.7241	0.7241	130.9661
6.00	0.075	0.0090	0.5000	0.0125	0.2512		0.9377	1.0000	180.1063
8.00	0.075	0.0090	0.5000	0.0125	0.3074		1.1143	1.0000	116.1131
10.00	0.075	0.0090	0.5000	0.0125	0.3606		1.2659	1.0000	100.3739
12.00	0.075	0.0090	0.5000	0.0125	0.4114		1.4015	1.0000	86.7007
2.00	0.075	0.0090	0.7070	0.0125	0.1076		0.5646	0.4280	95.2693
4.00	0.075	0.0090	0.7070	0.0125	0.1696		0.9092	0.7241	144.5376
6.00	0.075	0.0090	0.7070	0.0125	0.2230		1.1626	1.0000	186.7263
8.00	0.075	0.0090	0.7070	0.0125	0.2722		1.4117	1.0000	122.6924
10.00	0.075	0.0090	0.7070	0.0125	0.3186		1.6108	1.0000	106.0962
12.00	0.075	0.0090	0.7070	0.0125	0.3630		1.7872	1.0000	97.2992
2.00	0.075	0.0090	0.8660	0.0125	0.1008		0.6421	0.4280	94.1411
4.00	0.075	0.0090	0.8660	0.0125	0.1596		1.0369	0.7241	149.6831
6.00	0.075	0.0090	0.8660	0.0125	0.2081		1.3543	1.0000	190.2578
8.00	0.075	0.0090	0.8660	0.0125	0.2537		1.6213	1.0000	126.2323
10.00	0.075	0.0090	0.8660	0.0125	0.2966		1.8539	1.0000	112.0943
12.00	0.075	0.0090	0.8660	0.0125	0.3372		2.0659	1.0000	101.4938
2.00	0.075	0.0090	0.9659	0.0125	0.0974		0.6872	0.4280	93.5734
4.00	0.075	0.0090	0.9659	0.0125	0.1530		1.1131	0.7241	152.3165
6.00	0.075	0.0090	0.9659	0.0125	0.2006		1.4567	1.0000	192.0643
8.00	0.075	0.0090	0.9659	0.0125	0.2444		1.7445	1.0000	126.0131
10.00	0.075	0.0090	0.9659	0.0125	0.2854		1.9990	1.0000	114.2195
12.00	0.075	0.0090	0.9659	0.0125	0.3245		2.2277	1.0000	104.3309
2.00	0.075	0.0090	0.9962	0.0125	0.0964		0.7010	0.4280	93.4091
4.00	0.075	0.0090	0.9962	0.0125	0.1512		1.1381	0.7241	152.1167
6.00	0.075	0.0090	0.9962	0.0125	0.1984		1.4587	1.0000	192.5079
8.00	0.075	0.0090	0.9962	0.0125	0.2416		1.7547	1.0000	126.0556
10.00	0.075	0.0090	0.9962	0.0125	0.2820		2.0470	1.0000	114.0577
12.00	0.075	0.0090	0.9962	0.0125	0.3210		2.2746	1.0000	104.9089

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH NORMAL DEPTH L/D.
2.00	0.075	0.0120	0.2588	0.0500	0.1810	0.2102	0.3191	36.6319
4.00	0.075	0.0120	0.2588	0.0500	0.2913	0.3257	0.5298	57.1439
6.00	0.075	0.0120	0.2588	0.0500	0.3894	0.4116	0.7241	72.1624
8.00	0.075	0.0120	0.2588	0.0500	0.4812	0.4813	0.9116	84.3317
10.00	0.075	0.0120	0.2588	0.0500	0.5696	0.5388	1.0000	56.6411
12.00	0.075	0.0120	0.2588	0.0500	0.6548	0.5901	1.0000	37.2790
2.00	0.075	0.0120	0.5000	0.0500	0.1454	0.3157	0.3191	40.7864
4.00	0.075	0.0120	0.5000	0.0500	0.2316	0.4980	0.5298	63.8034
6.00	0.075	0.0120	0.5000	0.0500	0.3074	0.6369	0.7241	80.7601
8.00	0.075	0.0120	0.5000	0.0500	0.3777	0.7511	0.9116	94.5010
10.00	0.075	0.0120	0.5000	0.0500	0.4446	0.8483	1.0000	66.5940
12.00	0.075	0.0120	0.5000	0.0500	0.5093	0.9326	1.0000	50.2442
2.00	0.075	0.0120	0.7070	0.0500	0.1298	0.3924	0.3191	42.4726
4.00	0.075	0.0120	0.7070	0.0500	0.2059	0.6232	0.5298	66.5518
6.00	0.075	0.0120	0.7070	0.0500	0.2722	0.8030	0.7241	84.4010
8.00	0.075	0.0120	0.7070	0.0500	0.3333	0.9533	0.9116	98.9051
10.00	0.075	0.0120	0.7070	0.0500	0.3918	1.0785	1.0000	73.8609
12.00	0.075	0.0120	0.7070	0.0500	0.4475	1.1918	1.0000	56.1702
2.00	0.075	0.0120	0.8660	0.0500	0.1214	0.4463	0.3191	43.3480
4.00	0.075	0.0120	0.8660	0.0500	0.1923	0.7117	0.5298	67.9977
6.00	0.075	0.0120	0.8660	0.0500	0.2537	0.9203	0.7241	86.3192
8.00	0.075	0.0120	0.8660	0.0500	0.3103	1.0940	0.9116	101.1972
10.00	0.075	0.0120	0.8660	0.0500	0.3640	1.2430	1.0000	76.7545
12.00	0.075	0.0120	0.8660	0.0500	0.4153	1.3762	1.0000	59.3613
2.00	0.075	0.0120	0.9659	0.0500	0.1172	0.4775	0.3191	43.7702
4.00	0.075	0.0120	0.9659	0.0500	0.1852	0.7655	0.5298	68.7412
6.00	0.075	0.0120	0.9659	0.0500	0.2444	0.9893	0.7241	87.2702
8.00	0.075	0.0120	0.9659	0.0500	0.2956	1.1788	0.9116	102.3732
10.00	0.075	0.0120	0.9659	0.0500	0.3499	1.3423	1.0000	78.2510
12.00	0.075	0.0120	0.9659	0.0500	0.3992	1.4857	1.0000	60.9831
2.00	0.075	0.0120	0.9962	0.0500	0.1160	0.4873	0.3191	43.9010
4.00	0.075	0.0120	0.9962	0.0500	0.1832	0.7814	0.5298	68.9451
6.00	0.075	0.0120	0.9962	0.0500	0.2416	1.0118	0.7241	87.5630
8.00	0.075	0.0120	0.9962	0.0500	0.2952	1.2055	0.9116	102.7165
10.00	0.075	0.0120	0.9962	0.0500	0.3459	1.3719	1.0000	78.6650
12.00	0.075	0.0120	0.9962	0.0500	0.3945	1.5180	1.0000	61.4283

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY RATIO	DEPTH M/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH TO NORMAL DEPTH. L/D.
2.00	0.075	0.0120	0.2568	0.0250	0.1810		0.2102	0.4099	45.5724
4.00	0.075	0.0120	0.2568	0.0250	0.2913		0.3257	0.6919	67.2437
6.00	0.075	0.0120	0.2568	0.0250	0.3394		0.4116	0.9556	80.0259
8.00	0.075	0.0120	0.2568	0.0250	0.4312		0.4813	1.0000	51.4024
10.00	0.075	0.0120	0.2568	0.0250	0.5698		0.5388	1.0000	38.6533
12.00	0.075	0.0120	0.2568	0.0250	0.6548		0.5901	1.0000	29.5558
2.00	0.075	0.0120	0.5000	0.0250	0.1454		0.3157	0.4099	49.1694
4.00	0.075	0.0120	0.5000	0.0250	0.2316		0.4980	0.6919	73.1474
6.00	0.075	0.0120	0.5000	0.0250	0.3074		0.6369	0.9556	87.7921
8.00	0.075	0.0120	0.5000	0.0250	0.3777		0.7511	1.0000	60.9585
10.00	0.075	0.0120	0.5000	0.0250	0.4446		0.8453	1.0000	49.6017
12.00	0.075	0.0120	0.5000	0.0250	0.5093		0.9326	1.0000	41.5505
2.00	0.075	0.0120	0.7070	0.0250	0.1296		0.3924	0.4099	50.7431
4.00	0.075	0.0120	0.7070	0.0250	0.2059		0.6232	0.6919	75.7575
6.00	0.075	0.0120	0.7070	0.0250	0.2722		0.8039	0.9556	91.2994
8.00	0.075	0.0120	0.7070	0.0250	0.3333		0.9533	1.0000	65.4339
10.00	0.075	0.0120	0.7070	0.0250	0.3918		1.0785	1.0000	54.6434
12.00	0.075	0.0120	0.7070	0.0250	0.4475		1.1918	1.0000	47.2525
2.00	0.075	0.0120	0.8660	0.0250	0.1214		0.4463	0.4099	51.5813
4.00	0.075	0.0120	0.8660	0.0250	0.1923		0.7117	0.6919	77.1529
6.00	0.075	0.0120	0.8660	0.0250	0.2537		0.9203	0.9556	93.1075
8.00	0.075	0.0120	0.8660	0.0250	0.3103		1.0940	1.0000	67.7947
10.00	0.075	0.0120	0.8660	0.0250	0.3640		1.2439	1.0000	57.4168
12.00	0.075	0.0120	0.8660	0.0250	0.4153		1.3762	1.0000	50.3509
2.00	0.075	0.0120	0.9659	0.0250	0.1172		0.4775	0.4099	51.9901
4.00	0.075	0.0120	0.9659	0.0250	0.1852		0.7655	0.6919	77.6931
6.00	0.075	0.0120	0.9659	0.0250	0.2444		0.9893	0.9556	94.1464
8.00	0.075	0.0120	0.9659	0.0250	0.2956		1.1780	1.0000	69.0142
10.00	0.075	0.0120	0.9659	0.0250	0.3499		1.3423	1.0000	58.0415
12.00	0.075	0.0120	0.9659	0.0250	0.3992		1.4857	1.0000	51.9112
2.00	0.075	0.0120	0.9962	0.0250	0.1160		0.4873	0.4099	52.1170
4.00	0.075	0.0120	0.9962	0.0250	0.1832		0.7814	0.6919	78.0950
6.00	0.075	0.0120	0.9962	0.0250	0.2416		1.0118	0.9556	94.4292
8.00	0.075	0.0120	0.9962	0.0250	0.2952		1.2059	1.0000	69.3712
10.00	0.075	0.0120	0.9962	0.0250	0.3459		1.3719	1.0000	59.2371
12.00	0.075	0.0120	0.9962	0.0250	0.3948		1.5160	1.0000	52.3443

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN ENTRY RATIO	FLOW DEPTH H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH TO NORMAL DEPTH. L/D.
2.00	0.075	0.0120	0.2566	0.0167	0.1810		0.2102	0.4753	46.1400
4.00	0.075	0.0120	0.2566	0.0167	0.2913		0.3257	0.8110	63.7326
6.00	0.075	0.0120	0.2566	0.0167	0.3894		0.4116	1.0000	56.9060
8.00	0.075	0.0120	0.2566	0.0167	0.4812		0.4813	1.0000	44.4526
10.00	0.075	0.0120	0.2566	0.0167	0.5698		0.5388	1.0000	35.4065
12.00	0.075	0.0120	0.2566	0.0167	0.6548		0.5901	1.0000	27.7305
2.00	0.075	0.0120	0.5000	0.0167	0.1454		0.3157	0.4753	49.6925
4.00	0.075	0.0120	0.5000	0.0167	0.2316		0.4980	0.8110	69.6196
6.00	0.075	0.0120	0.5000	0.0167	0.3074		0.6369	1.0000	64.7537
8.00	0.075	0.0120	0.5000	0.0167	0.3777		0.7511	1.0000	53.6033
10.00	0.075	0.0120	0.5000	0.0167	0.4446		0.8483	1.0000	46.0944
12.00	0.075	0.0120	0.5000	0.0167	0.5093		0.9326	1.0000	39.4850
2.00	0.075	0.0120	0.7070	0.0167	0.1296		0.3924	0.4753	51.2817
4.00	0.075	0.0120	0.7070	0.0167	0.2059		0.6232	0.8110	72.2718
6.00	0.075	0.0120	0.7070	0.0167	0.2722		0.8030	1.0000	66.3597
8.00	0.075	0.0120	0.7070	0.0167	0.3333		0.9533	1.0000	56.1776
10.00	0.075	0.0120	0.7070	0.0167	0.3918		1.0785	1.0000	51.0674
12.00	0.075	0.0120	0.7070	0.0167	0.4475		1.1918	1.0000	45.0718
2.00	0.075	0.0120	0.8660	0.0167	0.1214		0.4463	0.4753	52.1350
4.00	0.075	0.0120	0.8660	0.0167	0.1923		0.7117	0.8110	75.5536
6.00	0.075	0.0120	0.8660	0.0167	0.2537		0.9203	1.0000	70.3122
8.00	0.075	0.0120	0.8660	0.0167	0.3103		1.0940	1.0000	60.5129
10.00	0.075	0.0120	0.8660	0.0167	0.3640		1.2430	1.0000	53.8015
12.00	0.075	0.0120	0.8660	0.0167	0.4153		1.3762	1.0000	48.1232
2.00	0.075	0.0120	0.9659	0.0167	0.1172		0.4775	0.4753	53.2288
4.00	0.075	0.0120	0.9659	0.0167	0.1852		0.7655	0.8110	77.3659
6.00	0.075	0.0120	0.9659	0.0167	0.2444		0.9893	1.0000	71.3004
8.00	0.075	0.0120	0.9659	0.0167	0.2956		1.1768	1.0000	61.7246
10.00	0.075	0.0120	0.9659	0.0167	0.3449		1.3423	1.0000	55.2190
12.00	0.075	0.0120	0.9659	0.0167	0.3992		1.4857	1.0000	49.6831
2.00	0.075	0.0120	0.9962	0.0167	0.1160		0.4873	0.4753	53.6474
4.00	0.075	0.0120	0.9962	0.0167	0.1832		0.7814	0.8110	77.5495
6.00	0.075	0.0120	0.9962	0.0167	0.2416		1.0118	1.0000	71.6006
8.00	0.075	0.0120	0.9962	0.0167	0.2952		1.2055	1.0000	62.0600
10.00	0.075	0.0120	0.9962	0.0167	0.3459		1.3719	1.0000	55.6130
12.00	0.075	0.0120	0.9962	0.0167	0.3948		1.5180	1.0000	50.1125

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY RATIO	DEPTH H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH TO NORMAL DEPTH. L/D.
2.00	0.075	0.0120	0.2588	0.0125	0.1810		0.2102	0.5298	42.8450
4.00	0.075	0.0120	0.2588	0.0125	0.2913		0.3257	0.9116	52.7000
6.00	0.075	0.0120	0.2588	0.0125	0.3694		0.4116	1.0000	50.2493
8.00	0.075	0.0120	0.2588	0.0125	0.4812		0.4813	1.0000	41.6263
10.00	0.075	0.0120	0.2588	0.0125	0.5698		0.5388	1.0000	34.0004
12.00	0.075	0.0120	0.2588	0.0125	0.6548		0.5901	1.0000	28.2996
2.00	0.075	0.0120	0.5000	0.0125	0.1454		0.3157	0.5298	46.4392
4.00	0.075	0.0120	0.5000	0.0125	0.2316		0.4980	0.9116	56.2478
6.00	0.075	0.0120	0.5000	0.0125	0.3074		0.6369	1.0000	57.9905
8.00	0.075	0.0120	0.5000	0.0125	0.3777		0.7511	1.0000	51.0678
10.00	0.075	0.0120	0.5000	0.0125	0.4446		0.8483	1.0000	44.5647
12.00	0.075	0.0120	0.5000	0.0125	0.5093		0.9326	1.0000	38.5196
2.00	0.075	0.0120	0.7070	0.0125	0.1296		0.3924	0.5298	48.2791
4.00	0.075	0.0120	0.7070	0.0125	0.2059		0.6232	0.9116	60.7165
6.00	0.075	0.0120	0.7070	0.0125	0.2722		0.8030	1.0000	61.5560
8.00	0.075	0.0120	0.7070	0.0125	0.3333		0.9533	1.0000	55.4130
10.00	0.075	0.0120	0.7070	0.0125	0.3918		1.0785	1.0000	49.5045
12.00	0.075	0.0120	0.7070	0.0125	0.4475		1.1918	1.0000	44.0674
2.00	0.075	0.0120	0.8660	0.0125	0.1214		0.4463	0.5298	49.5536
4.00	0.075	0.0120	0.8660	0.0125	0.1923		0.7117	0.9116	62.0371
6.00	0.075	0.0120	0.8660	0.0125	0.2537		0.9203	1.0000	63.5053
8.00	0.075	0.0120	0.8660	0.0125	0.3103		1.0940	1.0000	57.7330
10.00	0.075	0.0120	0.8660	0.0125	0.3640		1.2439	1.0000	52.2220
12.00	0.075	0.0120	0.8660	0.0125	0.4153		1.3762	1.0000	47.1024
2.00	0.075	0.0120	0.9659	0.0125	0.1172		0.4775	0.5298	50.1335
4.00	0.075	0.0120	0.9659	0.0125	0.1852		0.7655	0.9116	62.7104
6.00	0.075	0.0120	0.9659	0.0125	0.2444		0.9893	1.0000	64.4575
8.00	0.075	0.0120	0.9659	0.0125	0.2986		1.1785	1.0000	58.4359
10.00	0.075	0.0120	0.9659	0.0125	0.3499		1.3423	1.0000	53.6323
12.00	0.075	0.0120	0.9659	0.0125	0.3992		1.4857	1.0000	48.8551
2.00	0.075	0.0120	0.9962	0.0125	0.1160		0.4873	0.5298	50.3745
4.00	0.075	0.0120	0.9962	0.0125	0.1832		0.7814	0.9116	62.9060
6.00	0.075	0.0120	0.9962	0.0125	0.2416		1.0110	1.0000	64.7300
8.00	0.075	0.0120	0.9962	0.0125	0.2952		1.2055	1.0000	59.2427
10.00	0.075	0.0120	0.9962	0.0125	0.3459		1.3719	1.0000	54.0251
12.00	0.075	0.0120	0.9962	0.0125	0.3945		1.5180	1.0000	49.0527

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH T NORMAL DEPTH. L/D.
2.00	0.075	0.0150	0.2500	0.0500	0.2103	0.1614	0.3743	25.2969
4.00	0.075	0.0150	0.2500	0.0500	0.3411	0.2471	0.6284	36.4986
6.00	0.075	0.0150	0.2500	0.0500	0.4567	0.3100	0.8647	46.9254
8.00	0.075	0.0150	0.2500	0.0500	0.5695	0.3602	1.0000	34.1350
10.00	0.075	0.0150	0.2500	0.0500	0.6763	0.4029	1.0000	21.5631
12.00	0.075	0.0150	0.2500	0.0500	0.7806	0.4391	1.0000	14.1641
2.00	0.075	0.0150	0.5000	0.0500	0.1686	0.2394	0.3743	28.1506
4.00	0.075	0.0150	0.5000	0.0500	0.2703	0.3731	0.6284	43.0255
6.00	0.075	0.0150	0.5000	0.0500	0.3606	0.4730	0.8647	52.7245
8.00	0.075	0.0150	0.5000	0.0500	0.4446	0.5549	1.0000	41.1453
10.00	0.075	0.0150	0.5000	0.0500	0.5249	0.6240	1.0000	29.3543
12.00	0.075	0.0150	0.5000	0.0500	0.6040	0.6811	1.0000	22.6614
2.00	0.075	0.0150	0.7070	0.0500	0.1503	0.2966	0.3743	29.3730
4.00	0.075	0.0150	0.7070	0.0500	0.2399	0.4659	0.6284	45.0014
6.00	0.075	0.0150	0.7070	0.0500	0.3186	0.5952	0.8647	55.3296
8.00	0.075	0.0150	0.7070	0.0500	0.3918	0.7008	1.0000	44.3932
10.00	0.075	0.0150	0.7070	0.0500	0.4617	0.7904	1.0000	33.0452
12.00	0.075	0.0150	0.7070	0.0500	0.5288	0.8692	1.0000	26.7842
2.00	0.075	0.0150	0.8660	0.0500	0.1405	0.3369	0.3743	30.0179
4.00	0.075	0.0150	0.8660	0.0500	0.2238	0.5316	0.6284	46.0559
6.00	0.075	0.0150	0.8660	0.0500	0.2966	0.6813	0.8647	56.7205
8.00	0.075	0.0150	0.8660	0.0500	0.3640	0.8053	1.0000	46.1728
10.00	0.075	0.0150	0.8660	0.0500	0.4280	0.9116	1.0000	35.0805
12.00	0.075	0.0150	0.8660	0.0500	0.4897	1.0038	1.0000	29.0426
2.00	0.075	0.0150	0.9659	0.0500	0.1356	0.3605	0.3743	30.3385
4.00	0.075	0.0150	0.9659	0.0500	0.2155	0.5714	0.6284	46.6006
6.00	0.075	0.0150	0.9659	0.0500	0.2854	0.7334	0.8647	57.4335
8.00	0.075	0.0150	0.9659	0.0500	0.3499	0.8665	1.0000	47.0947
10.00	0.075	0.0150	0.9659	0.0500	0.4114	0.9827	1.0000	36.1150
12.00	0.075	0.0150	0.9659	0.0500	0.4705	1.0833	1.0000	30.1873
2.00	0.075	0.0150	0.9962	0.0500	0.1342	0.3681	0.3743	30.4343
4.00	0.075	0.0150	0.9962	0.0500	0.2133	0.5827	0.6284	46.7449
6.00	0.075	0.0150	0.9962	0.0500	0.2820	0.7505	0.8647	57.6578
8.00	0.075	0.0150	0.9962	0.0500	0.3459	0.8874	1.0000	47.3508
10.00	0.075	0.0150	0.9962	0.0500	0.4065	1.0054	1.0000	36.4204
12.00	0.075	0.0150	0.9962	0.0500	0.4651	1.1073	1.0000	30.5096

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH TO NORMAL DEPTH. L/D.
2.00	0.075	0.0150	0.2586	0.0250	0.2103	0.1614	0.4832	27.6673
4.00	0.075	0.0150	0.2586	0.0250	0.3411	0.2471	0.8257	37.3750
6.00	0.075	0.0150	0.2586	0.0250	0.4587	0.3100	1.0000	31.7661
8.00	0.075	0.0150	0.2586	0.0250	0.5698	0.3602	1.0000	23.6765
10.00	0.075	0.0150	0.2586	0.0250	0.6763	0.4029	1.0000	17.5449
12.00	0.075	0.0150	0.2586	0.0250	0.7808	0.4391	1.0000	12.1973
2.00	0.075	0.0150	0.5000	0.0250	0.1686	0.2394	0.4832	30.2307
4.00	0.075	0.0150	0.5000	0.0250	0.2703	0.3731	0.8257	41.5546
6.00	0.075	0.0150	0.5000	0.0250	0.3606	0.4730	1.0000	37.2575
8.00	0.075	0.0150	0.5000	0.0250	0.4446	0.5549	1.0000	30.1712
10.00	0.075	0.0150	0.5000	0.0250	0.5249	0.6240	1.0000	24.6314
12.00	0.075	0.0150	0.5000	0.0250	0.6040	0.6811	1.0000	20.1304
2.00	0.075	0.0150	0.7070	0.0250	0.1503	0.2966	0.4832	31.4041
4.00	0.075	0.0150	0.7070	0.0250	0.2399	0.4659	0.8257	43.4919
6.00	0.075	0.0150	0.7070	0.0250	0.3206	0.5952	1.0000	39.6557
8.00	0.075	0.0150	0.7070	0.0250	0.3928	0.7006	1.0000	33.2589
10.00	0.075	0.0150	0.7070	0.0250	0.4617	0.7904	1.0000	26.3351
12.00	0.075	0.0150	0.7070	0.0250	0.5296	0.8692	1.0000	24.0826
2.00	0.075	0.0150	0.8660	0.0250	0.1405	0.3369	0.4832	32.0373
4.00	0.075	0.0150	0.8660	0.0250	0.2238	0.5316	0.8257	44.5476
6.00	0.075	0.0150	0.8660	0.0250	0.2966	0.6813	1.0000	41.2662
8.00	0.075	0.0150	0.8660	0.0250	0.3640	0.8053	1.0000	34.9682
10.00	0.075	0.0150	0.8660	0.0250	0.4260	0.9116	1.0000	30.3131
12.00	0.075	0.0150	0.8660	0.0250	0.4897	1.0038	1.0000	26.2075
2.00	0.075	0.0150	0.9659	0.0250	0.1356	0.3605	0.4832	32.3551
4.00	0.075	0.0150	0.9659	0.0250	0.2155	0.5714	0.8257	45.0930
6.00	0.075	0.0150	0.9659	0.0250	0.2854	0.7334	1.0000	42.0015
8.00	0.075	0.0150	0.9659	0.0250	0.3499	0.8685	1.0000	35.6555
10.00	0.075	0.0150	0.9659	0.0250	0.4114	0.9827	1.0000	31.3129
12.00	0.075	0.0150	0.9659	0.0250	0.4705	1.0833	1.0000	27.3469
2.00	0.075	0.0150	0.9962	0.0250	0.1342	0.3681	0.4832	32.4517
4.00	0.075	0.0150	0.9962	0.0250	0.2133	0.5827	0.8257	45.2444
6.00	0.075	0.0150	0.9962	0.0250	0.2820	0.7505	1.0000	42.2269
8.00	0.075	0.0150	0.9962	0.0250	0.3459	0.8874	1.0000	36.1553
10.00	0.075	0.0150	0.9962	0.0250	0.4065	1.0054	1.0000	31.5104
12.00	0.075	0.0150	0.9962	0.0250	0.4651	1.1073	1.0000	27.5073

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH NORMAL DEPTH. L/D.
2.00	0.075	0.0150	0.2586	0.0167	0.2103	0.1614	0.5630	23.0455
4.00	0.075	0.0150	0.2588	0.0167	0.3411	0.2471	0.9712	23.4572
6.00	0.075	0.0150	0.2588	0.0167	0.4587	0.3100	1.0000	27.1040
8.00	0.075	0.0150	0.2588	0.0167	0.5698	0.3602	1.0000	21.7743
10.00	0.075	0.0150	0.2588	0.0167	0.6763	0.4029	1.0000	18.5560
12.00	0.075	0.0150	0.2588	0.0167	0.7806	0.4391	1.0000	11.6657
2.00	0.075	0.0150	0.5000	0.0167	0.1686	0.2394	0.5630	25.6075
4.00	0.075	0.0150	0.5000	0.0167	0.2703	0.3731	0.9712	25.2314
6.00	0.075	0.0150	0.5000	0.0167	0.3606	0.4730	1.0000	32.4483
8.00	0.075	0.0150	0.5000	0.0167	0.4446	0.5549	1.0000	26.1099
10.00	0.075	0.0150	0.5000	0.0167	0.5249	0.6240	1.0000	23.6846
12.00	0.075	0.0150	0.5000	0.0167	0.6040	0.6811	1.0000	19.4281
2.00	0.075	0.0150	0.7070	0.0167	0.1503	0.2966	0.5630	26.8014
4.00	0.075	0.0150	0.7070	0.0167	0.2399	0.4659	0.9712	22.2852
6.00	0.075	0.0150	0.7070	0.0167	0.3186	0.5952	1.0000	35.0068
8.00	0.075	0.0150	0.7070	0.0167	0.3918	0.7008	1.0000	31.1552
10.00	0.075	0.0150	0.7070	0.0167	0.4617	0.7904	1.0000	27.1438
12.00	0.075	0.0150	0.7070	0.0167	0.5288	0.8692	1.0000	23.3270
2.00	0.075	0.0150	0.8660	0.0167	0.1405	0.3369	0.5630	27.4506
4.00	0.075	0.0150	0.8660	0.0167	0.2236	0.5316	0.9712	34.7112
6.00	0.075	0.0150	0.8660	0.0167	0.2966	0.6813	1.0000	36.4031
8.00	0.075	0.0150	0.8660	0.0167	0.3640	0.8053	1.0000	32.8464
10.00	0.075	0.0150	0.8660	0.0167	0.4280	0.9116	1.0000	29.0952
12.00	0.075	0.0150	0.8660	0.0167	0.4897	1.0038	1.0000	25.4914
2.00	0.075	0.0150	0.9659	0.0167	0.1356	0.3605	0.5630	27.7777
4.00	0.075	0.0150	0.9659	0.0167	0.2155	0.5714	0.9712	72.5963
6.00	0.075	0.0150	0.9659	0.0167	0.2854	0.7334	1.0000	37.1311
8.00	0.075	0.0150	0.9659	0.0167	0.3499	0.8685	1.0000	33.7281
10.00	0.075	0.0150	0.9659	0.0167	0.4114	0.9827	1.0000	30.0390
12.00	0.075	0.0150	0.9659	0.0167	0.4705	1.0833	1.0000	26.5948
2.00	0.075	0.0150	0.9962	0.0167	0.1342	0.3681	0.5630	27.8759
4.00	0.075	0.0150	0.9962	0.0167	0.2133	0.5827	0.9712	57.7446
6.00	0.075	0.0150	0.9962	0.0167	0.2820	0.7505	1.0000	37.3542
8.00	0.075	0.0150	0.9962	0.0167	0.3459	0.8874	1.0000	33.9738
10.00	0.075	0.0150	0.9962	0.0167	0.4065	1.0054	1.0000	30.3541
12.00	0.075	0.0150	0.9962	0.0167	0.4651	1.1073	1.0000	26.9063

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH TO NORMAL DEPTH. L/D.
2.00	0.075	0.0150	0.2566	0.0125	0.2103	0.1614	0.6264	6.5979
4.00	0.075	0.0150	0.2568	0.0125	0.3411	0.2471	1.0000	22.6261
6.00	0.075	0.0150	0.2566	0.0125	0.4567	0.3100	1.0000	25.4236
8.00	0.075	0.0150	0.2566	0.0125	0.5698	0.3602	1.0000	20.9417
10.00	0.075	0.0150	0.2566	0.0125	0.6763	0.4029	1.0000	16.1022
12.00	0.075	0.0150	0.2566	0.0125	0.7808	0.4391	1.0000	11.4143
2.00	0.075	0.0150	0.5000	0.0125	0.1656	0.2394	0.6264	16.9069
4.00	0.075	0.0150	0.5000	0.0125	0.2703	0.3731	1.0000	26.7413
6.00	0.075	0.0150	0.5000	0.0125	0.3606	0.4730	1.0000	30.7095
8.00	0.075	0.0150	0.5000	0.0125	0.4446	0.5549	1.0000	27.2073
10.00	0.075	0.0150	0.5000	0.0125	0.5249	0.6240	1.0000	23.1525
12.00	0.075	0.0150	0.5000	0.0125	0.6040	0.6811	1.0000	19.0957
2.00	0.075	0.0150	0.7070	0.0125	0.1503	0.2966	0.6264	17.4996
4.00	0.075	0.0150	0.7070	0.0125	0.2399	0.4659	1.0000	28.7259
6.00	0.075	0.0150	0.7070	0.0125	0.3186	0.5952	1.0000	33.2500
8.00	0.075	0.0150	0.7070	0.0125	0.3918	0.7003	1.0000	30.2323
10.00	0.075	0.0150	0.7070	0.0125	0.4617	0.7904	1.0000	26.5855
12.00	0.075	0.0150	0.7070	0.0125	0.5288	0.8692	1.0000	22.9662
2.00	0.075	0.0150	0.8660	0.0125	0.1405	0.3369	0.6264	18.3400
4.00	0.075	0.0150	0.8660	0.0125	0.2238	0.5316	1.0000	29.5342
6.00	0.075	0.0150	0.8660	0.0125	0.2966	0.6813	1.0000	34.5590
8.00	0.075	0.0150	0.8660	0.0125	0.3640	0.8053	1.0000	31.9146
10.00	0.075	0.0150	0.8660	0.0125	0.4280	0.9116	1.0000	28.5527
12.00	0.075	0.0150	0.8660	0.0125	0.4897	1.0036	1.0000	25.1193
2.00	0.075	0.0150	0.9659	0.0125	0.1356	0.3605	0.6264	19.1724
4.00	0.075	0.0150	0.9659	0.0125	0.2155	0.5714	1.0000	30.4169
6.00	0.075	0.0150	0.9659	0.0125	0.2854	0.7334	1.0000	35.3537
8.00	0.075	0.0150	0.9659	0.0125	0.3499	0.8685	1.0000	32.7943
10.00	0.075	0.0150	0.9659	0.0125	0.4114	0.9827	1.0000	29.5151
12.00	0.075	0.0150	0.9659	0.0125	0.4705	1.0833	1.0000	26.2179
2.00	0.075	0.0150	0.9962	0.0125	0.1342	0.3681	0.6264	19.5493
4.00	0.075	0.0150	0.9962	0.0125	0.2133	0.5827	1.0000	30.5727
6.00	0.075	0.0150	0.9962	0.0125	0.2820	0.7505	1.0000	35.5559
8.00	0.075	0.0150	0.9962	0.0125	0.3459	0.8874	1.0000	33.0370
10.00	0.075	0.0150	0.9962	0.0125	0.4065	1.0004	1.0000	29.8124
12.00	0.075	0.0150	0.9962	0.0125	0.4651	1.1073	1.0000	26.5250

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH NORMAL DEPTH L/D.
2.00	0.075	0.0130	0.2586	0.0500	0.2384	0.1312	0.4280	18.0963
4.00	0.075	0.0130	0.2586	0.0500	0.3894	0.1992	0.7241	25.8504
6.00	0.075	0.0130	0.2586	0.0500	0.5259	0.2491	1.0000	31.1132
8.00	0.075	0.0130	0.2586	0.0500	0.6548	0.2896	1.0000	15.8033
10.00	0.075	0.0130	0.2586	0.0500	0.7808	0.3226	1.0000	10.1463
12.00	0.075	0.0130	0.2586	0.0500	0.9028	0.3523	1.0000	5.7360
2.00	0.075	0.0130	0.5000	0.0500	0.1906	0.1917	0.4280	20.1423
4.00	0.075	0.0130	0.5000	0.0500	0.3074	0.2959	0.7241	29.0764
6.00	0.075	0.0130	0.5000	0.0500	0.4114	0.3735	1.0000	36.3344
8.00	0.075	0.0130	0.5000	0.0500	0.5093	0.4357	1.0000	20.6052
10.00	0.075	0.0130	0.5000	0.0500	0.6040	0.4868	1.0000	15.4670
12.00	0.075	0.0130	0.5000	0.0500	0.6948	0.5326	1.0000	11.5412
2.00	0.075	0.0130	0.7070	0.0500	0.1696	0.2368	0.4280	21.0638
4.00	0.075	0.0130	0.7070	0.0500	0.2722	0.3682	0.7241	30.5722
6.00	0.075	0.0130	0.7070	0.0500	0.3630	0.4672	1.0000	38.8052
8.00	0.075	0.0130	0.7070	0.0500	0.4475	0.5484	1.0000	22.9777
10.00	0.075	0.0130	0.7070	0.0500	0.5268	0.6157	1.0000	16.1660
12.00	0.075	0.0130	0.7070	0.0500	0.6079	0.6733	1.0000	14.4672
2.00	0.075	0.0130	0.8660	0.0500	0.1586	0.2682	0.4280	21.5576
4.00	0.075	0.0130	0.8660	0.0500	0.2537	0.4196	0.7241	31.3847
6.00	0.075	0.0130	0.8660	0.0500	0.3372	0.5354	1.0000	40.1904
8.00	0.075	0.0130	0.8660	0.0500	0.4153	0.6289	1.0000	24.2904
10.00	0.075	0.0130	0.8660	0.0500	0.4897	0.7083	1.0000	19.6673
12.00	0.075	0.0130	0.8660	0.0500	0.5620	0.7765	1.0000	16.1354
2.00	0.075	0.0130	0.9659	0.0500	0.1530	0.2869	0.4280	21.8064
4.00	0.075	0.0130	0.9659	0.0500	0.2444	0.4499	0.7241	31.7962
6.00	0.075	0.0130	0.9659	0.0500	0.3245	0.5752	1.0000	40.8821
8.00	0.075	0.0130	0.9659	0.0500	0.3992	0.6770	1.0000	24.9652
10.00	0.075	0.0130	0.9659	0.0500	0.4705	0.7631	1.0000	20.4338
12.00	0.075	0.0130	0.9659	0.0500	0.5396	0.8373	1.0000	16.9527
2.00	0.075	0.0130	0.9962	0.0500	0.1512	0.2930	0.4280	21.8546
4.00	0.075	0.0130	0.9962	0.0500	0.2416	0.4598	0.7241	31.9215
6.00	0.075	0.0130	0.9962	0.0500	0.3210	0.5867	1.0000	41.0595
8.00	0.075	0.0130	0.9962	0.0500	0.3945	0.6911	1.0000	25.1514
10.00	0.075	0.0130	0.9962	0.0500	0.4651	0.7796	1.0000	20.6502
12.00	0.075	0.0130	0.9962	0.0500	0.5337	0.8544	1.0000	17.2071

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN ENTRY RATIO	FLOW DEPTH H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH TO NORMAL DEPTH. L/D.
2.00	0.075	0.0130	0.2588	0.0250		0.2384	0.1312	0.5542	15.5035
4.00	0.075	0.0130	0.2588	0.0250		0.3894	0.1992	0.9556	14.5247
6.00	0.075	0.0130	0.2588	0.0250		0.5259	0.2491	1.0000	10.8705
8.00	0.075	0.0130	0.2588	0.0250		0.6546	0.2896	1.0000	12.7463
10.00	0.075	0.0130	0.2588	0.0250		0.7808	0.3228	1.0000	8.7651
12.00	0.075	0.0130	0.2588	0.0250		0.9028	0.3523	1.0000	5.1641
2.00	0.075	0.0130	0.5000	0.0250		0.1906	0.1917	0.5542	17.4220
4.00	0.075	0.0130	0.5000	0.0250		0.3074	0.2959	0.9556	20.4574
6.00	0.075	0.0130	0.5000	0.0250		0.4114	0.3735	1.0000	20.7414
8.00	0.075	0.0130	0.5000	0.0250		0.5093	0.4357	1.0000	17.2358
10.00	0.075	0.0130	0.5000	0.0250		0.6040	0.4868	1.0000	13.7744
12.00	0.075	0.0130	0.5000	0.0250		0.6945	0.5325	1.0000	10.5843
2.00	0.075	0.0130	0.7070	0.0250		0.1696	0.2368	0.5542	18.3434
4.00	0.075	0.0130	0.7070	0.0250		0.2722	0.3682	0.9556	21.0553
6.00	0.075	0.0130	0.7070	0.0250		0.3630	0.4672	1.0000	22.0454
8.00	0.075	0.0130	0.7070	0.0250		0.4475	0.5484	1.0000	19.5114
10.00	0.075	0.0130	0.7070	0.0250		0.5286	0.6157	1.0000	16.3655
12.00	0.075	0.0130	0.7070	0.0250		0.6079	0.6733	1.0000	13.3952
2.00	0.075	0.0130	0.8660	0.0250		0.1556	0.2682	0.5542	18.8404
4.00	0.075	0.0130	0.8660	0.0250		0.2537	0.4196	0.9556	21.5995
6.00	0.075	0.0130	0.8660	0.0250		0.3372	0.5354	1.0000	23.7257
8.00	0.075	0.0130	0.8660	0.0250		0.4153	0.6289	1.0000	20.7525
10.00	0.075	0.0130	0.8660	0.0250		0.4897	0.7083	1.0000	17.3220
12.00	0.075	0.0130	0.8660	0.0250		0.5620	0.7765	1.0000	13.9123
2.00	0.075	0.0130	0.9659	0.0250		0.1530	0.2969	0.5542	19.0950
4.00	0.075	0.0130	0.9659	0.0250		0.2444	0.4499	0.9556	21.3950
6.00	0.075	0.0130	0.9659	0.0250		0.3245	0.5752	1.0000	24.2700
8.00	0.075	0.0130	0.9659	0.0250		0.3992	0.6770	1.0000	21.4334
10.00	0.075	0.0130	0.9659	0.0250		0.4705	0.7631	1.0000	16.9657
12.00	0.075	0.0130	0.9659	0.0250		0.5396	0.8373	1.0000	13.5373
2.00	0.075	0.0130	0.9962	0.0250		0.1512	0.2930	0.5542	19.1760
4.00	0.075	0.0130	0.9962	0.0250		0.2416	0.4546	0.9556	21.9912
6.00	0.075	0.0130	0.9962	0.0250		0.3210	0.5867	1.0000	24.4152
8.00	0.075	0.0130	0.9962	0.0250		0.3946	0.6911	1.0000	21.5204
10.00	0.075	0.0130	0.9962	0.0250		0.4651	0.7796	1.0000	17.0777
12.00	0.075	0.0130	0.9962	0.0250		0.5337	0.8544	1.0000	13.6561

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH T NORMAL DEPTH. L/D.
2.00	0.075	0.0130	0.2588	0.0167	0.2384	0.1312	0.6470	2.4537
4.00	0.075	0.0130	0.2588	0.0167	0.3894	0.1992	1.0000	13.9947
6.00	0.075	0.0130	0.2588	0.0167	0.5259	0.2491	1.0000	15.3240
8.00	0.075	0.0130	0.2588	0.0167	0.6548	0.2896	1.0000	12.0116
10.00	0.075	0.0130	0.2588	0.0167	0.7808	0.3228	1.0000	8.4164
12.00	0.075	0.0130	0.2588	0.0167	0.9028	0.3523	1.0000	5.0115
2.00	0.075	0.0130	0.5000	0.0167	0.1906	0.1917	0.6470	8.8134
4.00	0.075	0.0130	0.5000	0.0167	0.3074	0.2959	1.0000	16.9502
6.00	0.075	0.0130	0.5000	0.0167	0.4114	0.3735	1.0000	19.1147
8.00	0.075	0.0130	0.5000	0.0167	0.5093	0.4357	1.0000	16.4089
10.00	0.075	0.0130	0.5000	0.0167	0.6040	0.4868	1.0000	13.3035
12.00	0.075	0.0130	0.5000	0.0167	0.6948	0.5326	1.0000	10.3037
2.00	0.075	0.0130	0.7070	0.0167	0.1696	0.2368	0.6470	9.2045
4.00	0.075	0.0130	0.7070	0.0167	0.2722	0.3682	1.0000	18.4214
6.00	0.075	0.0130	0.7070	0.0167	0.3630	0.4672	1.0000	20.9941
8.00	0.075	0.0130	0.7070	0.0167	0.4475	0.5484	1.0000	18.6545
10.00	0.075	0.0130	0.7070	0.0167	0.5288	0.6157	1.0000	15.8610
12.00	0.075	0.0130	0.7070	0.0167	0.6079	0.6733	1.0000	13.0784
2.00	0.075	0.0130	0.8660	0.0167	0.1586	0.2682	0.6470	9.3122
4.00	0.075	0.0130	0.8660	0.0167	0.2537	0.4196	1.0000	19.2442
6.00	0.075	0.0130	0.8660	0.0167	0.3372	0.5354	1.0000	22.0631
8.00	0.075	0.0130	0.8660	0.0167	0.4153	0.6289	1.0000	19.9131
10.00	0.075	0.0130	0.8660	0.0167	0.4897	0.7083	1.0000	17.3018
12.00	0.075	0.0130	0.8660	0.0167	0.5620	0.7765	1.0000	14.6792
2.00	0.075	0.0130	0.9659	0.0167	0.1530	0.2869	0.6470	9.3341
4.00	0.075	0.0130	0.9659	0.0167	0.2444	0.4499	1.0000	19.6668
6.00	0.075	0.0130	0.9659	0.0167	0.3245	0.5752	1.0000	22.6026
8.00	0.075	0.0130	0.9659	0.0167	0.3992	0.6770	1.0000	20.5635
10.00	0.075	0.0130	0.9659	0.0167	0.4705	0.7631	1.0000	18.0410
12.00	0.075	0.0130	0.9659	0.0167	0.5396	0.8373	1.0000	15.4970
2.00	0.075	0.0130	0.9962	0.0167	0.1512	0.2930	0.6470	9.3346
4.00	0.075	0.0130	0.9962	0.0167	0.2416	0.4598	1.0000	19.7964
6.00	0.075	0.0130	0.9962	0.0167	0.3210	0.5867	1.0000	22.7496
8.00	0.075	0.0130	0.9962	0.0167	0.3948	0.6911	1.0000	20.7436
10.00	0.075	0.0130	0.9962	0.0167	0.4651	0.7796	1.0000	18.2503
12.00	0.075	0.0130	0.9962	0.0167	0.5337	0.8544	1.0000	15.7141

D = 0.10

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO M/D.	ENTRY ENERGY M.	NORMAL DEPTH M/D.	PIPE LENGTH NORMAL DEPT L/D.
2.00	0.100	0.0090	0.2566	0.0500	0.0908	0.2566	0.1549	34.5674
4.00	0.100	0.0090	0.2566	0.0500	0.1422	0.4174	0.2478	56.9953
6.00	0.100	0.0090	0.2566	0.0500	0.1864	0.5467	0.3293	76.3511
8.00	0.100	0.0090	0.2566	0.0500	0.2267	0.6575	0.4050	94.2911
10.00	0.100	0.0090	0.2566	0.0500	0.2644	0.7555	0.4778	109.7734
12.00	0.100	0.0090	0.2566	0.0500	0.3005	0.8426	0.5483	124.0704
2.00	0.100	0.0090	0.5000	0.0500	0.0737	0.3830	0.1549	30.9276
4.00	0.100	0.0090	0.5000	0.0500	0.1148	0.6302	0.2478	65.7402
6.00	0.100	0.0090	0.5000	0.0500	0.1495	0.8355	0.3293	87.4115
8.00	0.100	0.0090	0.5000	0.0500	0.1813	1.0108	0.4050	105.3044
10.00	0.100	0.0090	0.5000	0.0500	0.2108	1.1679	0.4778	122.5379
12.00	0.100	0.0090	0.5000	0.0500	0.2389	1.3099	0.5483	138.4490
2.00	0.100	0.0090	0.7070	0.0500	0.0660	0.4749	0.1549	40.5040
4.00	0.100	0.0090	0.7070	0.0500	0.1026	0.7849	0.2478	66.3774
6.00	0.100	0.0090	0.7070	0.0500	0.1334	1.0441	0.3293	90.9339
8.00	0.100	0.0090	0.7070	0.0500	0.1615	1.2668	0.4050	109.6459
10.00	0.100	0.0090	0.7070	0.0500	0.1874	1.4704	0.4778	127.6413
12.00	0.100	0.0090	0.7070	0.0500	0.2120	1.6537	0.5483	144.2115
2.00	0.100	0.0090	0.8660	0.0500	0.0620	0.5374	0.1549	41.2826
4.00	0.100	0.0090	0.8660	0.0500	0.0961	0.8921	0.2478	69.7013
6.00	0.100	0.0090	0.8660	0.0500	0.1249	1.1891	0.3293	92.7224
8.00	0.100	0.0090	0.8660	0.0500	0.1510	1.4457	0.4050	111.8750
10.00	0.100	0.0090	0.8660	0.0500	0.1752	1.6785	0.4778	130.2163
12.00	0.100	0.0090	0.8660	0.0500	0.1979	1.8942	0.5483	147.1742
2.00	0.100	0.0090	0.9659	0.0500	0.0595	0.5752	0.1549	41.6779
4.00	0.100	0.0090	0.9659	0.0500	0.0928	0.9555	0.2478	70.3554
6.00	0.100	0.0090	0.9659	0.0500	0.1205	1.2748	0.3293	93.8111
8.00	0.100	0.0090	0.9659	0.0500	0.1456	1.5526	0.4050	112.9936
10.00	0.100	0.0090	0.9659	0.0500	0.1688	1.8052	0.4778	131.5399
12.00	0.100	0.0090	0.9659	0.0500	0.1906	2.0352	0.5483	148.8333
2.00	0.100	0.0090	0.9962	0.0500	0.0593	0.5858	0.1549	41.7740
4.00	0.100	0.0090	0.9962	0.0500	0.0919	0.9757	0.2478	70.5521
6.00	0.100	0.0090	0.9962	0.0500	0.1193	1.3006	0.3293	93.8593
8.00	0.100	0.0090	0.9962	0.0500	0.1442	1.5839	0.4050	113.2957
10.00	0.100	0.0090	0.9962	0.0500	0.1671	1.8413	0.4778	131.8433
12.00	0.100	0.0090	0.9962	0.0500	0.1888	2.0770	0.5483	149.0401

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH TO NORMAL DEPTH. L/D.
2.00	0.100	0.0090	0.2568	0.0250	0.0908	0.2566	0.1954	46.2220
4.00	0.100	0.0090	0.2568	0.0250	0.1422	0.4174	0.3157	79.0829
6.00	0.100	0.0090	0.2568	0.0250	0.1864	0.5467	0.4231	103.9569
8.00	0.100	0.0090	0.2568	0.0250	0.2267	0.6575	0.5239	124.1655
10.00	0.100	0.0090	0.2568	0.0250	0.2644	0.7555	0.6216	142.9249
12.00	0.100	0.0090	0.2568	0.0250	0.3005	0.8426	0.7163	160.4177
2.00	0.100	0.0090	0.5000	0.0250	0.0737	0.3830	0.1954	51.5902
4.00	0.100	0.0090	0.5000	0.0250	0.1148	0.6302	0.3157	84.7493
6.00	0.100	0.0090	0.5000	0.0250	0.1495	0.8355	0.4231	111.6337
8.00	0.100	0.0090	0.5000	0.0250	0.1813	1.0106	0.5239	133.5376
10.00	0.100	0.0090	0.5000	0.0250	0.2108	1.1679	0.6216	153.6321
12.00	0.100	0.0090	0.5000	0.0250	0.2389	1.3099	0.7163	172.8358
2.00	0.100	0.0090	0.7070	0.0250	0.0660	0.4749	0.1954	53.0059
4.00	0.100	0.0090	0.7070	0.0250	0.1026	0.7849	0.3157	87.1553
6.00	0.100	0.0090	0.7070	0.0250	0.1334	1.0441	0.4231	114.8756
8.00	0.100	0.0090	0.7070	0.0250	0.1615	1.2666	0.5239	137.6047
10.00	0.100	0.0090	0.7070	0.0250	0.1874	1.4704	0.6216	158.6159
12.00	0.100	0.0090	0.7070	0.0250	0.2120	1.6537	0.7163	176.2345
2.00	0.100	0.0090	0.8660	0.0250	0.0620	0.5374	0.1954	53.7292
4.00	0.100	0.0090	0.8660	0.0250	0.0961	0.8921	0.3157	86.4023
6.00	0.100	0.0090	0.8660	0.0250	0.1249	1.1891	0.4231	116.5537
8.00	0.100	0.0090	0.8660	0.0250	0.1510	1.4457	0.5239	139.7161
10.00	0.100	0.0090	0.8660	0.0250	0.1752	1.6785	0.6216	161.0579
12.00	0.100	0.0090	0.8660	0.0250	0.1979	1.8942	0.7163	179.0773
2.00	0.100	0.0090	0.9659	0.0250	0.0548	0.5752	0.1954	54.0994
4.00	0.100	0.0090	0.9659	0.0250	0.0928	0.9555	0.3157	89.0296
6.00	0.100	0.0090	0.9659	0.0250	0.1205	1.2748	0.4231	117.4149
8.00	0.100	0.0090	0.9659	0.0250	0.1456	1.5526	0.5239	140.7670
10.00	0.100	0.0090	0.9659	0.0250	0.1688	1.8052	0.6216	162.3401
12.00	0.100	0.0090	0.9659	0.0250	0.1908	2.0352	0.7163	180.4483
2.00	0.100	0.0090	0.9962	0.0250	0.0533	0.5858	0.1954	54.1952
4.00	0.100	0.0090	0.9962	0.0250	0.0919	0.9757	0.3157	89.2143
6.00	0.100	0.0090	0.9962	0.0250	0.1193	1.3006	0.4231	117.6555
8.00	0.100	0.0090	0.9962	0.0250	0.1442	1.5839	0.5239	141.0913
10.00	0.100	0.0090	0.9962	0.0250	0.1671	1.8416	0.6216	162.8547
12.00	0.100	0.0090	0.9962	0.0250	0.1888	2.0770	0.7163	180.9571

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO M/D.	ENTRY ENERGY M.	NORMAL DEPTH M/D.	PIPE LENGTH NORMAL DEPT: L/D.
2.00	0.100	0.0090	0.2588	0.0167	0.0908	0.2566	0.2242	55.3242
4.00	0.100	0.0090	0.2588	0.0167	0.1422	0.4174	0.3645	88.3575
6.00	0.100	0.0090	0.2588	0.0167	0.1864	0.5467	0.4917	116.6239
8.00	0.100	0.0090	0.2588	0.0167	0.2267	0.6575	0.6108	136.5984
10.00	0.100	0.0090	0.2588	0.0167	0.2644	0.7555	0.7271	155.0115
12.00	0.100	0.0090	0.2588	0.0167	0.3005	0.8426	0.8403	169.9533
2.00	0.100	0.0090	0.5000	0.0167	0.0737	0.3830	0.2242	58.5317
4.00	0.100	0.0090	0.5000	0.0167	0.1148	0.6302	0.3645	94.3193
6.00	0.100	0.0090	0.5000	0.0167	0.1495	0.8355	0.4917	124.0119
8.00	0.100	0.0090	0.5000	0.0167	0.1813	1.0106	0.6108	145.7469
10.00	0.100	0.0090	0.5000	0.0167	0.2106	1.1679	0.7271	165.6941
12.00	0.100	0.0090	0.5000	0.0167	0.2389	1.3099	0.8403	182.1046
2.00	0.100	0.0090	0.7070	0.0167	0.0660	0.4749	0.2242	59.9177
4.00	0.100	0.0090	0.7070	0.0167	0.1026	0.7849	0.3645	96.6964
6.00	0.100	0.0090	0.7070	0.0167	0.1334	1.0441	0.4917	127.2047
8.00	0.100	0.0090	0.7070	0.0167	0.1615	1.2663	0.6108	149.7349
10.00	0.100	0.0090	0.7070	0.0167	0.1874	1.4704	0.7271	170.4153
12.00	0.100	0.0090	0.7070	0.0167	0.2120	1.6537	0.8403	187.4975
2.00	0.100	0.0090	0.8660	0.0167	0.0620	0.5374	0.2242	60.6250
4.00	0.100	0.0090	0.8660	0.0167	0.0961	0.8921	0.3645	97.9393
6.00	0.100	0.0090	0.8660	0.0167	0.1249	1.1891	0.4917	128.8841
8.00	0.100	0.0090	0.8660	0.0167	0.1510	1.4457	0.6108	153.1153
10.00	0.100	0.0090	0.8660	0.0167	0.1752	1.6785	0.7271	155.6619
12.00	0.100	0.0090	0.8660	0.0167	0.1979	1.8942	0.8403	176.0026
2.00	0.100	0.0090	0.9659	0.0167	0.0598	0.5752	0.2242	60.9943
4.00	0.100	0.0090	0.9659	0.0167	0.0928	0.9555	0.3645	98.5559
6.00	0.100	0.0090	0.9659	0.0167	0.1205	1.2748	0.4917	128.9151
8.00	0.100	0.0090	0.9659	0.0167	0.1456	1.5525	0.6108	156.8503
10.00	0.100	0.0090	0.9659	0.0167	0.1688	1.8052	0.7271	142.6715
12.00	0.100	0.0090	0.9659	0.0167	0.1908	2.0352	0.8403	172.9536
2.00	0.100	0.0090	0.9962	0.0167	0.0593	0.5858	0.2242	61.0893
4.00	0.100	0.0090	0.9962	0.0167	0.0919	0.9757	0.3645	98.7526
6.00	0.100	0.0090	0.9962	0.0167	0.1193	1.3006	0.4917	128.8254
8.00	0.100	0.0090	0.9962	0.0167	0.1442	1.5839	0.6108	157.8617
10.00	0.100	0.0090	0.9962	0.0167	0.1671	1.8415	0.7271	139.1501
12.00	0.100	0.0090	0.9962	0.0167	0.1888	2.0770	0.8403	171.5673

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH TO NORMAL DEPTH. L/D.
2.00	0.100	0.0090	0.2586	0.0125	0.0908	0.2566	0.2478	59.4008
4.00	0.100	0.0090	0.2586	0.0125	0.1422	0.4174	0.4050	94.3054
6.00	0.100	0.0090	0.2586	0.0125	0.1864	0.5467	0.5463	121.5631
8.00	0.100	0.0090	0.2586	0.0125	0.2267	0.6675	0.6841	141.8921
10.00	0.100	0.0090	0.2586	0.0125	0.2644	0.7555	0.8149	156.9853
12.00	0.100	0.0090	0.2586	0.0125	0.3005	0.8425	0.9438	169.8335
2.00	0.100	0.0090	0.5000	0.0125	0.0737	0.3830	0.2478	62.6199
4.00	0.100	0.0090	0.5000	0.0125	0.1148	0.6302	0.4050	99.7118
6.00	0.100	0.0090	0.5000	0.0125	0.1495	0.8355	0.5483	126.9154
8.00	0.100	0.0090	0.5000	0.0125	0.1813	1.0108	0.6841	150.9735
10.00	0.100	0.0090	0.5000	0.0125	0.2107	1.1679	0.8149	167.6933
12.00	0.100	0.0090	0.5000	0.0125	0.2389	1.3099	0.9438	182.0309
2.00	0.100	0.0090	0.7070	0.0125	0.0660	0.4749	0.2478	64.0026
4.00	0.100	0.0090	0.7070	0.0125	0.1026	0.7849	0.4050	102.0411
6.00	0.100	0.0090	0.7070	0.0125	0.1334	1.0441	0.5463	130.9371
8.00	0.100	0.0090	0.7070	0.0125	0.1615	1.2665	0.6841	151.6551
10.00	0.100	0.0090	0.7070	0.0125	0.1874	1.4704	0.8149	170.2452
12.00	0.100	0.0090	0.7070	0.0125	0.2120	1.6537	0.9438	195.3250
2.00	0.100	0.0090	0.8660	0.0125	0.0620	0.5374	0.2478	64.6025
4.00	0.100	0.0090	0.8660	0.0125	0.0961	0.8921	0.4050	107.1075
6.00	0.100	0.0090	0.8660	0.0125	0.1249	1.1891	0.5463	130.9212
8.00	0.100	0.0090	0.8660	0.0125	0.1510	1.4457	0.6841	150.5441
10.00	0.100	0.0090	0.8660	0.0125	0.1752	1.6785	0.8149	169.5655
12.00	0.100	0.0090	0.8660	0.0125	0.1979	1.8942	0.9438	202.4440
2.00	0.100	0.0090	0.9659	0.0125	0.0598	0.5752	0.2478	64.3265
4.00	0.100	0.0090	0.9659	0.0125	0.0926	0.9555	0.4050	109.3554
6.00	0.100	0.0090	0.9659	0.0125	0.1205	1.2748	0.5463	130.1474
8.00	0.100	0.0090	0.9659	0.0125	0.1456	1.5526	0.6841	149.4590
10.00	0.100	0.0090	0.9659	0.0125	0.1686	1.8052	0.8149	166.0067
12.00	0.100	0.0090	0.9659	0.0125	0.1905	2.0352	0.9438	206.0693
2.00	0.100	0.0090	0.9962	0.0125	0.0593	0.5758	0.2478	64.2551
4.00	0.100	0.0090	0.9962	0.0125	0.0919	0.9757	0.4050	110.7157
6.00	0.100	0.0090	0.9962	0.0125	0.1193	1.3006	0.5463	130.0000
8.00	0.100	0.0090	0.9962	0.0125	0.1442	1.5939	0.6841	149.7900
10.00	0.100	0.0090	0.9962	0.0125	0.1671	1.8414	0.8149	166.9067
12.00	0.100	0.0090	0.9962	0.0125	0.1886	2.0770	0.9438	207.0193

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH NORMAL DEPTH L/D.
2.00	0.100	0.0120	0.2588	0.0500	0.1092	0.1819	0.1879	23.6006
4.00	0.100	0.0120	0.2588	0.0500	0.1722	0.2921	0.3030	38.9858
6.00	0.100	0.0120	0.2588	0.0500	0.2267	0.3797	0.4050	50.6793
8.00	0.100	0.0120	0.2588	0.0500	0.2766	0.4540	0.5015	61.3337
10.00	0.100	0.0120	0.2588	0.0500	0.3235	0.5194	0.5942	70.6521
12.00	0.100	0.0120	0.2588	0.0500	0.3689	0.5762	0.6841	78.2467
2.00	0.100	0.0120	0.5000	0.0500	0.0854	0.2695	0.1879	26.2454
4.00	0.100	0.0120	0.5000	0.0500	0.1385	0.4387	0.3030	43.3731
6.00	0.100	0.0120	0.5000	0.0500	0.1813	0.5765	0.4050	56.5109
8.00	0.100	0.0120	0.5000	0.0500	0.2203	0.6939	0.5015	68.3543
10.00	0.100	0.0120	0.5000	0.0500	0.2566	0.7998	0.5942	78.8214
12.00	0.100	0.0120	0.5000	0.0500	0.2917	0.8915	0.6841	87.3712
2.00	0.100	0.0120	0.7070	0.0500	0.0792	0.3332	0.1879	27.3069
4.00	0.100	0.0120	0.7070	0.0500	0.1237	0.5457	0.3030	45.1449
6.00	0.100	0.0120	0.7070	0.0500	0.1615	0.7196	0.4050	58.8853
8.00	0.100	0.0120	0.7070	0.0500	0.1957	0.8715	0.5015	71.3121
10.00	0.100	0.0120	0.7070	0.0500	0.2279	1.0041	0.5942	82.1718
12.00	0.100	0.0120	0.7070	0.0500	0.2585	1.1238	0.6841	91.1901
2.00	0.100	0.0120	0.8660	0.0500	0.0743	0.3769	0.1879	27.8400
4.00	0.100	0.0120	0.8660	0.0500	0.1158	0.6199	0.3030	46.0493
6.00	0.100	0.0120	0.8660	0.0500	0.1510	0.8198	0.4050	60.1146
8.00	0.100	0.0120	0.8660	0.0500	0.1827	0.9951	0.5015	72.8201
10.00	0.100	0.0120	0.8660	0.0500	0.2125	1.1497	0.5942	83.9449
12.00	0.100	0.0120	0.8660	0.0500	0.2408	1.2894	0.6841	93.2107
2.00	0.100	0.0120	0.9659	0.0500	0.0717	0.4036	0.1879	28.1133
4.00	0.100	0.0120	0.9659	0.0500	0.1118	0.6641	0.3030	46.5043
6.00	0.100	0.0120	0.9659	0.0500	0.1456	0.8797	0.4050	60.7357
8.00	0.100	0.0120	0.9659	0.0500	0.1761	1.0689	0.5015	73.5814
10.00	0.100	0.0120	0.9659	0.0500	0.2050	1.2338	0.5942	84.8119
12.00	0.100	0.0120	0.9659	0.0500	0.2321	1.3862	0.6841	94.2115
2.00	0.100	0.0120	0.9962	0.0500	0.0710	0.4117	0.1879	28.1907
4.00	0.100	0.0120	0.9962	0.0500	0.1107	0.6771	0.3030	46.6272
6.00	0.100	0.0120	0.9962	0.0500	0.1442	0.8973	0.4050	60.9042
8.00	0.100	0.0120	0.9962	0.0500	0.1744	1.0894	0.5015	73.7760
10.00	0.100	0.0120	0.9962	0.0500	0.2028	1.2600	0.5942	85.0630
12.00	0.100	0.0120	0.9962	0.0500	0.2296	1.4150	0.6841	94.4071

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH TO NORMAL DEPTH L/D.
2.00	0.100	0.0120	0.2588	0.0167	0.1092	0.1819	0.2737	32.8456
4.00	0.100	0.0120	0.2588	0.0167	0.1722	0.2921	0.4500	50.8930
6.00	0.100	0.0120	0.2588	0.0167	0.2267	0.3797	0.6108	63.3560
8.00	0.100	0.0120	0.2588	0.0167	0.2756	0.4540	0.7651	72.5126
10.00	0.100	0.0120	0.2588	0.0167	0.3235	0.5194	0.9146	78.5055
12.00	0.100	0.0120	0.2588	0.0167	0.3689	0.5762	1.0000	70.5504
2.00	0.100	0.0120	0.5000	0.0167	0.0884	0.2695	0.2737	35.0273
4.00	0.100	0.0120	0.5000	0.0167	0.1385	0.4387	0.4500	54.6024
6.00	0.100	0.0120	0.5000	0.0167	0.1813	0.5765	0.6108	68.3731
8.00	0.100	0.0120	0.5000	0.0167	0.2203	0.6939	0.7651	78.6076
10.00	0.100	0.0120	0.5000	0.0167	0.2566	0.7998	0.9146	85.8197
12.00	0.100	0.0120	0.5000	0.0167	0.2917	0.8915	1.0000	78.9110
2.00	0.100	0.0120	0.7070	0.0167	0.0792	0.3332	0.2737	35.9955
4.00	0.100	0.0120	0.7070	0.0167	0.1237	0.5457	0.4500	56.2617
6.00	0.100	0.0120	0.7070	0.0167	0.1615	0.7195	0.6108	70.6233
8.00	0.100	0.0120	0.7070	0.0167	0.1957	0.8715	0.7651	81.4703
10.00	0.100	0.0120	0.7070	0.0167	0.2279	1.0041	0.9146	77.6570
12.00	0.100	0.0120	0.7070	0.0167	0.2585	1.1235	1.0000	82.7310
2.00	0.100	0.0120	0.8660	0.0167	0.0743	0.3769	0.2737	36.5011
4.00	0.100	0.0120	0.8660	0.0167	0.1158	0.6199	0.4500	57.1389
6.00	0.100	0.0120	0.8660	0.0167	0.1510	0.8198	0.6108	72.3396
8.00	0.100	0.0120	0.8660	0.0167	0.1827	0.9951	0.7651	80.4325
10.00	0.100	0.0120	0.8660	0.0167	0.2125	1.1497	0.9146	79.2355
12.00	0.100	0.0120	0.8660	0.0167	0.2408	1.2894	1.0000	84.5131
2.00	0.100	0.0120	0.9659	0.0167	0.0717	0.4036	0.2737	36.7647
4.00	0.100	0.0120	0.9659	0.0167	0.1118	0.6641	0.4500	56.2225
6.00	0.100	0.0120	0.9659	0.0167	0.1456	0.8797	0.6108	73.0122
8.00	0.100	0.0120	0.9659	0.0167	0.1761	1.0684	0.7651	79.0193
10.00	0.100	0.0120	0.9659	0.0167	0.2050	1.2336	0.9146	75.2732
12.00	0.100	0.0120	0.9659	0.0167	0.2321	1.3862	1.0000	85.3570
2.00	0.100	0.0120	0.9962	0.0167	0.0710	0.4117	0.2737	36.8399
4.00	0.100	0.0120	0.9962	0.0167	0.1107	0.6771	0.4500	56.7402
6.00	0.100	0.0120	0.9962	0.0167	0.1442	0.8973	0.6108	74.2157
8.00	0.100	0.0120	0.9962	0.0167	0.1744	1.0894	0.7651	79.4057
10.00	0.100	0.0120	0.9962	0.0167	0.2025	1.2600	0.9146	74.7153
12.00	0.100	0.0120	0.9962	0.0167	0.2296	1.4150	1.0000	86.1459

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH 1 NORMAL DEPTH. L/D.
2.00	0.100	0.0120	0.2588	0.0250	0.1092	0.1819	0.2377	30.2759
4.00	0.100	0.0120	0.2588	0.0250	0.1722	0.2921	0.3879	48.5540
6.00	0.100	0.0120	0.2588	0.0250	0.2267	0.3797	0.5239	62.4405
8.00	0.100	0.0120	0.2588	0.0250	0.2756	0.4540	0.6528	73.1600
10.00	0.100	0.0120	0.2588	0.0250	0.3235	0.5194	0.7778	81.9359
12.00	0.100	0.0120	0.2588	0.0250	0.3669	0.5762	0.8999	88.7532
2.00	0.100	0.0120	0.5000	0.0250	0.0884	0.2695	0.2377	32.5305
4.00	0.100	0.0120	0.5000	0.0250	0.1365	0.4387	0.3879	52.3407
6.00	0.100	0.0120	0.5000	0.0250	0.1813	0.5765	0.5239	67.5335
8.00	0.100	0.0120	0.5000	0.0250	0.2203	0.6939	0.6528	79.4039
10.00	0.100	0.0120	0.5000	0.0250	0.2566	0.7998	0.7778	89.1859
12.00	0.100	0.0120	0.5000	0.0250	0.2917	0.8915	0.8999	96.9417
2.00	0.100	0.0120	0.7070	0.0250	0.0792	0.3332	0.2377	33.5090
4.00	0.100	0.0120	0.7070	0.0250	0.1237	0.5457	0.3879	54.0068
6.00	0.100	0.0120	0.7070	0.0250	0.1615	0.7196	0.5239	69.7640
8.00	0.100	0.0120	0.7070	0.0250	0.1957	0.8715	0.6528	82.1642
10.00	0.100	0.0120	0.7070	0.0250	0.2279	1.0041	0.7778	92.3982
12.00	0.100	0.0120	0.7070	0.0250	0.2585	1.1238	0.8999	100.6163
2.00	0.100	0.0120	0.8660	0.0250	0.0743	0.3769	0.2377	34.0100
4.00	0.100	0.0120	0.8660	0.0250	0.1158	0.6199	0.3879	54.8775
6.00	0.100	0.0120	0.8660	0.0250	0.1510	0.8198	0.5239	70.9434
8.00	0.100	0.0120	0.8660	0.0250	0.1827	0.9951	0.6528	83.6523
10.00	0.100	0.0120	0.8660	0.0250	0.2125	1.1497	0.7778	94.1379
12.00	0.100	0.0120	0.8660	0.0250	0.2408	1.2894	0.8999	102.6067
2.00	0.100	0.0120	0.9659	0.0250	0.0717	0.4036	0.2377	34.2793
4.00	0.100	0.0120	0.9659	0.0250	0.1118	0.6641	0.3879	55.3210
6.00	0.100	0.0120	0.9659	0.0250	0.1456	0.8797	0.5239	71.5533
8.00	0.100	0.0120	0.9659	0.0250	0.1761	1.0689	0.6528	84.4010
10.00	0.100	0.0120	0.9659	0.0250	0.2050	1.2338	0.7778	94.9975
12.00	0.100	0.0120	0.9659	0.0250	0.2321	1.3862	0.8999	103.6023
2.00	0.100	0.0120	0.9962	0.0250	0.0710	0.4117	0.2377	34.3542
4.00	0.100	0.0120	0.9962	0.0250	0.1107	0.6771	0.3879	55.4413
6.00	0.100	0.0120	0.9962	0.0250	0.1442	0.8973	0.5239	71.7130
8.00	0.100	0.0120	0.9962	0.0250	0.1744	1.0894	0.6528	84.5954
10.00	0.100	0.0120	0.9962	0.0250	0.2028	1.2600	0.7778	95.2473
12.00	0.100	0.0120	0.9962	0.0250	0.2296	1.4150	0.8999	103.8797

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN ENTRY RATIO	FLOW DEPTH H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH TO NORMAL DEPTH. L/D.
2.00	0.100	0.0120	0.2566	0.0125	0.1092		0.1819	0.3030	32.6191
4.00	0.100	0.0120	0.2566	0.0125	0.1722		0.2921	0.5015	49.0061
6.00	0.100	0.0120	0.2566	0.0125	0.2267		0.3797	0.6841	56.8049
8.00	0.100	0.0120	0.2566	0.0125	0.2766		0.4540	0.8509	64.1542
10.00	0.100	0.0120	0.2566	0.0125	0.3239		0.5194	1.0000	65.0564
12.00	0.100	0.0120	0.2566	0.0125	0.3689		0.5762	1.0000	59.3669
2.00	0.100	0.0120	0.5000	0.0125	0.0884		0.2695	0.3030	34.8062
4.00	0.100	0.0120	0.5000	0.0125	0.1385		0.4387	0.5015	52.7402
6.00	0.100	0.0120	0.5000	0.0125	0.1813		0.5765	0.6841	63.8773
8.00	0.100	0.0120	0.5000	0.0125	0.2203		0.6939	0.8509	70.4113
10.00	0.100	0.0120	0.5000	0.0125	0.2566		0.7995	1.0000	72.3524
12.00	0.100	0.0120	0.5000	0.0125	0.2917		0.8915	1.0000	67.5750
2.00	0.100	0.0120	0.7070	0.0125	0.0792		0.3332	0.3030	35.7892
4.00	0.100	0.0120	0.7070	0.0125	0.1237		0.5457	0.5015	53.6059
6.00	0.100	0.0120	0.7070	0.0125	0.1615		0.7196	0.6841	65.6629
8.00	0.100	0.0120	0.7070	0.0125	0.1957		0.8715	0.8509	72.9650
10.00	0.100	0.0120	0.7070	0.0125	0.2279		1.0041	1.0000	75.6515
12.00	0.100	0.0120	0.7070	0.0125	0.2585		1.1239	1.0000	71.3477
2.00	0.100	0.0120	0.8660	0.0125	0.0743		0.3769	0.3030	36.0654
4.00	0.100	0.0120	0.8660	0.0125	0.1156		0.6199	0.5015	52.5119
6.00	0.100	0.0120	0.8660	0.0125	0.1510		0.8198	0.6841	66.4359
8.00	0.100	0.0120	0.8660	0.0125	0.1827		0.9951	0.8509	74.3143
10.00	0.100	0.0120	0.8660	0.0125	0.2125		1.1497	1.0000	77.4503
12.00	0.100	0.0120	0.8660	0.0125	0.2408		1.2894	1.0000	73.4075
2.00	0.100	0.0120	0.9659	0.0125	0.0717		0.4036	0.3030	36.1100
4.00	0.100	0.0120	0.9659	0.0125	0.1118		0.6641	0.5015	51.9450
6.00	0.100	0.0120	0.9659	0.0125	0.1455		0.8797	0.6841	66.5359
8.00	0.100	0.0120	0.9659	0.0125	0.1761		1.0689	0.8509	75.0045
10.00	0.100	0.0120	0.9659	0.0125	0.2050		1.2335	1.0000	76.3521
12.00	0.100	0.0120	0.9659	0.0125	0.2321		1.3862	1.0000	74.4425
2.00	0.100	0.0120	0.9962	0.0125	0.0710		0.4117	0.3030	36.1170
4.00	0.100	0.0120	0.9962	0.0125	0.1107		0.6771	0.5015	52.7577
6.00	0.100	0.0120	0.9962	0.0125	0.1442		0.8973	0.6841	66.9435
8.00	0.100	0.0120	0.9962	0.0125	0.1744		1.0894	0.8509	75.1335
10.00	0.100	0.0120	0.9962	0.0125	0.2027		1.2600	1.0000	76.0129
12.00	0.100	0.0120	0.9962	0.0125	0.2296		1.4150	1.0000	74.7301

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH NORMAL DEPTH L/D.
2.00	0.100	0.0150	0.2588	0.0500	0.1263	0.1404	0.2184	16.6500
4.00	0.100	0.0150	0.2588	0.0500	0.2001	0.2237	0.3552	27.3558
6.00	0.100	0.0150	0.2588	0.0500	0.2644	0.2889	0.4778	35.2204
8.00	0.100	0.0150	0.2588	0.0500	0.3235	0.3441	0.5942	42.0188
10.00	0.100	0.0150	0.2588	0.0500	0.3801	0.3907	0.7056	46.7749
12.00	0.100	0.0150	0.2588	0.0500	0.4343	0.4325	0.8149	51.1932
2.00	0.100	0.0150	0.5000	0.0500	0.1020	0.2062	0.2184	18.5129
4.00	0.100	0.0150	0.5000	0.0500	0.1605	0.3325	0.3552	30.3949
6.00	0.100	0.0150	0.5000	0.0500	0.2108	0.4339	0.4778	39.2389
8.00	0.100	0.0150	0.5000	0.0500	0.2566	0.5211	0.5942	46.8632
10.00	0.100	0.0150	0.5000	0.0500	0.3000	0.5961	0.7056	52.3797
12.00	0.100	0.0150	0.5000	0.0500	0.3420	0.6616	0.8149	57.4185
2.00	0.100	0.0150	0.7070	0.0500	0.0912	0.2540	0.2184	19.2531
4.00	0.100	0.0150	0.7070	0.0500	0.1432	0.4121	0.3552	31.6737
6.00	0.100	0.0150	0.7070	0.0500	0.1874	0.5413	0.4778	40.9653
8.00	0.100	0.0150	0.7070	0.0500	0.2279	0.6508	0.5942	48.9376
10.00	0.100	0.0150	0.7070	0.0500	0.2659	0.7476	0.7056	54.8147
12.00	0.100	0.0150	0.7070	0.0500	0.3020	0.8349	0.8149	60.2076
2.00	0.100	0.0150	0.8660	0.0500	0.0855	0.2874	0.2184	19.6837
4.00	0.100	0.0150	0.8660	0.0500	0.1339	0.4682	0.3552	32.3454
6.00	0.100	0.0150	0.8660	0.0500	0.1752	0.6155	0.4778	41.8573
8.00	0.100	0.0150	0.8660	0.0500	0.2125	0.7435	0.5942	50.0500
10.00	0.100	0.0150	0.8660	0.0500	0.2478	0.8548	0.7056	56.1120
12.00	0.100	0.0150	0.8660	0.0500	0.2815	0.9544	0.8149	61.6565
2.00	0.100	0.0150	0.9659	0.0500	0.0826	0.3072	0.2184	19.8852
4.00	0.100	0.0150	0.9659	0.0500	0.1293	0.5009	0.3552	32.6797
6.00	0.100	0.0150	0.9659	0.0500	0.1698	0.6607	0.4778	42.3201
8.00	0.100	0.0150	0.9659	0.0500	0.2050	0.7970	0.5942	50.5975
10.00	0.100	0.0150	0.9659	0.0500	0.2356	0.9189	0.7056	56.7715
12.00	0.100	0.0150	0.9659	0.0500	0.2708	1.0283	0.8149	62.4205
2.00	0.100	0.0150	0.9962	0.0500	0.0818	0.3125	0.2184	19.9352
4.00	0.100	0.0150	0.9962	0.0500	0.1278	0.5120	0.3552	32.7547
6.00	0.100	0.0150	0.9962	0.0500	0.1671	0.6737	0.4778	42.4444
8.00	0.100	0.0150	0.9962	0.0500	0.2028	0.8137	0.5942	50.7502
10.00	0.100	0.0150	0.9962	0.0500	0.2352	0.9371	0.7056	56.9430
12.00	0.100	0.0150	0.9962	0.0500	0.2678	1.0500	0.8149	62.6295

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH TO NORMAL DEPTH. L/D.
2.00	0.100	0.0150	0.2588	0.0250	0.1263	0.1404	0.2776	19.8050
4.00	0.100	0.0150	0.2588	0.0250	0.2001	0.2237	0.4573	30.7053
6.00	0.100	0.0150	0.2588	0.0250	0.2644	0.2989	0.6216	38.0392
8.00	0.100	0.0150	0.2588	0.0250	0.3235	0.3441	0.7778	42.7903
10.00	0.100	0.0150	0.2588	0.0250	0.3801	0.3907	0.9302	45.3750
12.00	0.100	0.0150	0.2588	0.0250	0.4343	0.4325	1.0000	39.4603
2.00	0.100	0.0150	0.5000	0.0250	0.1020	0.2062	0.2776	21.4309
4.00	0.100	0.0150	0.5000	0.0250	0.1605	0.3325	0.4573	33.4152
6.00	0.100	0.0150	0.5000	0.0250	0.2108	0.4339	0.6216	41.6651
8.00	0.100	0.0150	0.5000	0.0250	0.2506	0.5211	0.7778	47.1850
10.00	0.100	0.0150	0.5000	0.0250	0.3000	0.5961	0.9302	51.0515
12.00	0.100	0.0150	0.5000	0.0250	0.3420	0.6616	1.0000	45.3349
2.00	0.100	0.0150	0.7070	0.0250	0.0912	0.2540	0.2776	22.1556
4.00	0.100	0.0150	0.7070	0.0250	0.1432	0.4121	0.4573	34.6397
6.00	0.100	0.0150	0.7070	0.0250	0.1874	0.5413	0.6216	43.3302
8.00	0.100	0.0150	0.7070	0.0250	0.2279	0.6505	0.7778	49.2103
10.00	0.100	0.0150	0.7070	0.0250	0.2659	0.7476	0.9302	53.4375
12.00	0.100	0.0150	0.7070	0.0250	0.3020	0.8349	1.0000	46.1274
2.00	0.100	0.0150	0.8660	0.0250	0.0855	0.2874	0.2776	22.5422
4.00	0.100	0.0150	0.8660	0.0250	0.1339	0.4662	0.4573	35.3063
6.00	0.100	0.0150	0.8660	0.0250	0.1752	0.6155	0.6216	44.2111
8.00	0.100	0.0150	0.8660	0.0250	0.2125	0.7435	0.7778	50.3230
10.00	0.100	0.0150	0.8660	0.0250	0.2478	0.8546	0.9302	54.7350
12.00	0.100	0.0150	0.8660	0.0250	0.2815	0.9544	1.0000	49.6076
2.00	0.100	0.0150	0.9659	0.0250	0.0826	0.3072	0.2776	22.7390
4.00	0.100	0.0150	0.9659	0.0250	0.1293	0.5009	0.4573	35.6314
6.00	0.100	0.0150	0.9659	0.0250	0.1698	0.6607	0.6216	44.6724
8.00	0.100	0.0150	0.9659	0.0250	0.2050	0.7970	0.7778	50.8513
10.00	0.100	0.0150	0.9659	0.0250	0.2356	0.9183	0.9302	55.4007
12.00	0.100	0.0150	0.9659	0.0250	0.2708	1.0283	1.0000	50.3492
2.00	0.100	0.0150	0.9962	0.0250	0.0818	0.3125	0.2776	22.7681
4.00	0.100	0.0150	0.9962	0.0250	0.1278	0.5120	0.4573	35.7361
6.00	0.100	0.0150	0.9962	0.0250	0.1671	0.6737	0.6216	44.7758
8.00	0.100	0.0150	0.9962	0.0250	0.2025	0.8137	0.7778	51.0423
10.00	0.100	0.0150	0.9962	0.0250	0.2362	0.9371	0.9302	55.5795
12.00	0.100	0.0150	0.9962	0.0250	0.2678	1.0509	1.0000	50.6114

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH NORMAL DEPTH L/D.
2.00	0.100	0.0150	0.2586	0.0167	0.1263	0.1404	0.3201	16.9767
4.00	0.100	0.0150	0.2586	0.0167	0.2001	0.2237	0.5317	27.4700
6.00	0.100	0.0150	0.2586	0.0167	0.2644	0.2869	0.7271	31.2717
8.00	0.100	0.0150	0.2586	0.0167	0.3235	0.3441	0.9146	31.3958
10.00	0.100	0.0150	0.2586	0.0167	0.3801	0.3987	1.0000	34.2745
12.00	0.100	0.0150	0.2586	0.0167	0.4343	0.4325	1.0000	32.0298
2.00	0.100	0.0150	0.5000	0.0167	0.1020	0.2062	0.3201	20.5906
4.00	0.100	0.0150	0.5000	0.0167	0.1605	0.3325	0.5317	30.1662
6.00	0.100	0.0150	0.5000	0.0167	0.2108	0.4339	0.7271	34.9049
8.00	0.100	0.0150	0.5000	0.0167	0.2566	0.5211	0.9146	34.7729
10.00	0.100	0.0150	0.5000	0.0167	0.3000	0.5961	1.0000	39.3945
12.00	0.100	0.0150	0.5000	0.0167	0.3420	0.6616	1.0000	37.7511
2.00	0.100	0.0150	0.7070	0.0167	0.0912	0.2540	0.3201	21.3256
4.00	0.100	0.0150	0.7070	0.0167	0.1432	0.4121	0.5317	31.4382
6.00	0.100	0.0150	0.7070	0.0167	0.1874	0.5413	0.7271	36.6021
8.00	0.100	0.0150	0.7070	0.0167	0.2279	0.6508	0.9146	35.7424
10.00	0.100	0.0150	0.7070	0.0167	0.2659	0.7476	1.0000	41.7854
12.00	0.100	0.0150	0.7070	0.0167	0.3020	0.8349	1.0000	40.4953
2.00	0.100	0.0150	0.8660	0.0167	0.0855	0.2874	0.3201	21.7209
4.00	0.100	0.0150	0.8660	0.0167	0.1339	0.4682	0.5317	32.1797
6.00	0.100	0.0150	0.8660	0.0167	0.1752	0.6155	0.7271	37.5057
8.00	0.100	0.0150	0.8660	0.0167	0.2125	0.7435	0.9146	35.7701
10.00	0.100	0.0150	0.8660	0.0167	0.2478	0.8548	1.0000	43.0914
12.00	0.100	0.0150	0.8660	0.0167	0.2815	0.9544	1.0000	41.9543
2.00	0.100	0.0150	0.9659	0.0167	0.0826	0.3072	0.3201	21.9229
4.00	0.100	0.0150	0.9659	0.0167	0.1293	0.5009	0.5317	32.8039
6.00	0.100	0.0150	0.9659	0.0167	0.1688	0.6607	0.7271	37.9601
8.00	0.100	0.0150	0.9659	0.0167	0.2050	0.7970	0.9146	35.4811
10.00	0.100	0.0150	0.9659	0.0167	0.2386	0.9183	1.0000	43.7629
12.00	0.100	0.0150	0.9659	0.0167	0.2708	1.0283	1.0000	42.7326
2.00	0.100	0.0150	0.9962	0.0167	0.0818	0.3125	0.3201	21.9733
4.00	0.100	0.0150	0.9962	0.0167	0.1278	0.5120	0.5317	33.0017
6.00	0.100	0.0150	0.9962	0.0167	0.1671	0.6737	0.7271	38.1082
8.00	0.100	0.0150	0.9962	0.0167	0.2028	0.8137	0.9146	35.3344
10.00	0.100	0.0150	0.9962	0.0167	0.2362	0.9371	1.0000	43.9433
12.00	0.100	0.0150	0.9962	0.0167	0.2678	1.0500	1.0000	42.9462

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH TO NORMAL DEPTH. L/D.
2.00	0.100	0.0150	0.2588	0.0125	0.1263	0.1404	0.3552	15.8152
4.00	0.100	0.0150	0.2588	0.0125	0.2001	0.2237	0.5942	16.2155
6.00	0.100	0.0150	0.2588	0.0125	0.2644	0.2889	0.8149	16.0553
8.00	0.100	0.0150	0.2588	0.0125	0.3235	0.3441	1.0000	22.9474
10.00	0.100	0.0150	0.2588	0.0125	0.3801	0.3907	1.0000	30.7114
12.00	0.100	0.0150	0.2588	0.0125	0.4343	0.4325	1.0000	29.6873
2.00	0.100	0.0150	0.5000	0.0125	0.1020	0.2062	0.3552	17.3246
4.00	0.100	0.0150	0.5000	0.0125	0.1605	0.3325	0.5942	23.2361
6.00	0.100	0.0150	0.5000	0.0125	0.2108	0.4339	0.8149	26.7440
8.00	0.100	0.0150	0.5000	0.0125	0.2566	0.5211	1.0000	26.7255
10.00	0.100	0.0150	0.5000	0.0125	0.3000	0.5961	1.0000	35.7013
12.00	0.100	0.0150	0.5000	0.0125	0.3420	0.6616	1.0000	35.3444
2.00	0.100	0.0150	0.7070	0.0125	0.0912	0.2540	0.3552	18.0009
4.00	0.100	0.0150	0.7070	0.0125	0.1432	0.4121	0.5942	23.7756
6.00	0.100	0.0150	0.7070	0.0125	0.1874	0.5413	0.8149	24.6054
8.00	0.100	0.0150	0.7070	0.0125	0.2279	0.6508	1.0000	26.5257
10.00	0.100	0.0150	0.7070	0.0125	0.2659	0.7476	1.0000	30.1559
12.00	0.100	0.0150	0.7070	0.0125	0.3020	0.8349	1.0000	30.0676
2.00	0.100	0.0150	0.8660	0.0125	0.0855	0.2874	0.3552	18.3555
4.00	0.100	0.0150	0.8660	0.0125	0.1339	0.4682	0.5942	24.1323
6.00	0.100	0.0150	0.8660	0.0125	0.1752	0.6155	0.8149	24.0626
8.00	0.100	0.0150	0.8660	0.0125	0.2125	0.7435	1.0000	29.5313
10.00	0.100	0.0150	0.8660	0.0125	0.2478	0.8548	1.0000	39.4547
12.00	0.100	0.0150	0.8660	0.0125	0.2815	0.9544	1.0000	39.5213
2.00	0.100	0.0150	0.9659	0.0125	0.0826	0.3072	0.3552	18.5358
4.00	0.100	0.0150	0.9659	0.0125	0.1293	0.5009	0.5942	24.3150
6.00	0.100	0.0150	0.9659	0.0125	0.1688	0.6607	0.8149	24.6021
8.00	0.100	0.0150	0.9659	0.0125	0.2050	0.7979	1.0000	30.0378
10.00	0.100	0.0150	0.9659	0.0125	0.2386	0.9188	1.0000	40.1269
12.00	0.100	0.0150	0.9659	0.0125	0.2708	1.0283	1.0000	40.2956
2.00	0.100	0.0150	0.9962	0.0125	0.0815	0.3125	0.3552	18.5555
4.00	0.100	0.0150	0.9962	0.0125	0.1278	0.5120	0.5942	24.3757
6.00	0.100	0.0150	0.9962	0.0125	0.1671	0.6737	0.8149	24.6477
8.00	0.100	0.0150	0.9962	0.0125	0.2028	0.8137	1.0000	30.1852
10.00	0.100	0.0150	0.9962	0.0125	0.2362	0.9371	1.0000	40.3053
12.00	0.100	0.0150	0.9962	0.0125	0.2678	1.0500	1.0000	40.5053

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY RATIO	DEPTH H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH NORMAL DEPT L/D.
2.00	0.100	0.0130	0.2588	0.0500	0.1422		0.1150	0.2478	12.3856
4.00	0.100	0.0130	0.2588	0.0500	0.2207		0.1814	0.4050	19.4377
6.00	0.100	0.0130	0.2588	0.0500	0.3005		0.2332	0.5483	24.9289
8.00	0.100	0.0130	0.2588	0.0500	0.3689		0.2766	0.6841	28.8658
10.00	0.100	0.0130	0.2588	0.0500	0.4343		0.3136	0.8149	31.5926
12.00	0.100	0.0130	0.2588	0.0500	0.4976		0.3462	0.9438	33.8859
2.00	0.100	0.0130	0.5000	0.0500	0.1143		0.1662	0.2478	13.7195
4.00	0.100	0.0130	0.5000	0.0500	0.1813		0.2663	0.4050	21.6457
6.00	0.100	0.0130	0.5000	0.0500	0.2389		0.3454	0.5483	27.8194
8.00	0.100	0.0130	0.5000	0.0500	0.2917		0.4124	0.6841	32.3343
10.00	0.100	0.0130	0.5000	0.0500	0.3420		0.4699	0.8149	35.5663
12.00	0.100	0.0130	0.5000	0.0500	0.3899		0.5218	0.9438	38.3230
2.00	0.100	0.0130	0.7070	0.0500	0.1026		0.2039	0.2478	14.3051
4.00	0.100	0.0130	0.7070	0.0500	0.1615		0.3288	0.4050	22.6220
6.00	0.100	0.0130	0.7070	0.0500	0.2120		0.4293	0.5483	29.1253
8.00	0.100	0.0130	0.7070	0.0500	0.2565		0.5138	0.6841	33.9152
10.00	0.100	0.0130	0.7070	0.0500	0.3020		0.5890	0.8149	37.4319
12.00	0.100	0.0130	0.7070	0.0500	0.3440		0.6546	0.9438	40.4007
2.00	0.100	0.0130	0.8660	0.0500	0.0961		0.2302	0.2478	14.6122
4.00	0.100	0.0130	0.8660	0.0500	0.1510		0.3728	0.4050	23.1413
6.00	0.100	0.0130	0.8660	0.0500	0.1979		0.4884	0.5483	29.8225
8.00	0.100	0.0130	0.8660	0.0500	0.2406		0.5864	0.6841	34.7701
10.00	0.100	0.0130	0.8660	0.0500	0.2815		0.6714	0.8149	38.4150
12.00	0.100	0.0130	0.8660	0.0500	0.3201		0.7484	0.9438	41.5252
2.00	0.100	0.0130	0.9659	0.0500	0.0928		0.2458	0.2478	14.7077
4.00	0.100	0.0130	0.9659	0.0500	0.1456		0.3991	0.4050	23.4078
6.00	0.100	0.0130	0.9659	0.0500	0.1908		0.5231	0.5483	30.1730
8.00	0.100	0.0130	0.9659	0.0500	0.2321		0.6290	0.6841	35.2075
10.00	0.100	0.0130	0.9659	0.0500	0.2708		0.7224	0.8149	38.9366
12.00	0.100	0.0130	0.9659	0.0500	0.3079		0.8052	0.9438	42.1059
2.00	0.100	0.0130	0.9962	0.0500	0.0919		0.2508	0.2478	14.8130
4.00	0.100	0.0130	0.9962	0.0500	0.1442		0.4068	0.4050	23.4804
6.00	0.100	0.0130	0.9962	0.0500	0.1888		0.5334	0.5483	30.2677
8.00	0.100	0.0130	0.9962	0.0500	0.2296		0.6417	0.6841	35.3250
10.00	0.100	0.0130	0.9962	0.0500	0.2675		0.7374	0.8149	39.0773
12.00	0.100	0.0130	0.9962	0.0500	0.3044		0.8223	0.9438	42.2700

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO M/D.	ENTRY ENERGY M.	NORMAL DEPTH M/D.	PIPE LENGTH TO NORMAL DEPTH. L/D.
2.00	0.100	0.0130	0.2566	0.0250	0.1422	0.1150	0.3157	12.6444
4.00	0.100	0.0130	0.2566	0.0250	0.2267	0.1614	0.5239	16.3104
6.00	0.100	0.0130	0.2566	0.0250	0.3005	0.2332	0.7163	21.0327
8.00	0.100	0.0130	0.2566	0.0250	0.3669	0.2766	0.8999	22.7092
10.00	0.100	0.0130	0.2566	0.0250	0.4343	0.3136	1.0000	22.2029
12.00	0.100	0.0130	0.2566	0.0250	0.4976	0.3462	1.0000	20.1535
2.00	0.100	0.0130	0.5000	0.0250	0.1148	0.1662	0.3157	13.8540
4.00	0.100	0.0130	0.5000	0.0250	0.1813	0.2663	0.5239	20.3515
6.00	0.100	0.0130	0.5000	0.0250	0.2369	0.3454	0.7163	23.7558
8.00	0.100	0.0130	0.5000	0.0250	0.2917	0.4124	0.8999	25.1934
10.00	0.100	0.0130	0.5000	0.0250	0.3429	0.4699	1.0000	25.9429
12.00	0.100	0.0130	0.5000	0.0250	0.3899	0.5218	1.0000	24.3777
2.00	0.100	0.0130	0.7070	0.0250	0.1026	0.2039	0.3157	14.4224
4.00	0.100	0.0130	0.7070	0.0250	0.1615	0.3288	0.5239	21.3103
6.00	0.100	0.0130	0.7070	0.0250	0.2120	0.4293	0.7163	25.0605
8.00	0.100	0.0130	0.7070	0.0250	0.2565	0.5138	0.8999	26.6155
10.00	0.100	0.0130	0.7070	0.0250	0.3020	0.5890	1.0000	27.7771
12.00	0.100	0.0130	0.7070	0.0250	0.3440	0.6546	1.0000	26.4252
2.00	0.100	0.0130	0.8660	0.0250	0.0961	0.2302	0.3157	14.7230
4.00	0.100	0.0130	0.8660	0.0250	0.1510	0.3723	0.5239	21.8322
6.00	0.100	0.0130	0.8660	0.0250	0.1979	0.4884	0.7163	25.7714
8.00	0.100	0.0130	0.8660	0.0250	0.2406	0.5864	0.8999	27.4154
10.00	0.100	0.0130	0.8660	0.0250	0.2815	0.6714	1.0000	28.7645
12.00	0.100	0.0130	0.8660	0.0250	0.3201	0.7484	1.0000	27.5532
2.00	0.100	0.0130	0.9659	0.0250	0.0928	0.2458	0.3157	14.8345
4.00	0.100	0.0130	0.9659	0.0250	0.1456	0.3991	0.5239	22.1019
6.00	0.100	0.0130	0.9659	0.0250	0.1908	0.5231	0.7163	26.1328
8.00	0.100	0.0130	0.9659	0.0250	0.2321	0.6290	0.8999	27.8233
10.00	0.100	0.0130	0.9659	0.0250	0.2705	0.7224	1.0000	29.2915
12.00	0.100	0.0130	0.9659	0.0250	0.3074	0.8052	1.0000	28.1413
2.00	0.100	0.0130	0.9962	0.0250	0.0919	0.2503	0.3157	14.9309
4.00	0.100	0.0130	0.9962	0.0250	0.1442	0.4065	0.5239	22.1759
6.00	0.100	0.0130	0.9962	0.0250	0.1888	0.5334	0.7163	26.2328
8.00	0.100	0.0130	0.9962	0.0250	0.2296	0.6417	0.8999	27.9372
10.00	0.100	0.0130	0.9962	0.0250	0.2679	0.7374	1.0000	29.4300
12.00	0.100	0.0130	0.9962	0.0250	0.3044	0.8223	1.0000	28.3073

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH NORMAL DEPTH L/D.
2.00	0.100	0.0130	0.2588	0.0167	0.1422	0.1150	0.3645	9.3670
4.00	0.100	0.0130	0.2588	0.0167	0.2267	0.1614	0.6108	12.1475
6.00	0.100	0.0130	0.2588	0.0167	0.3005	0.2332	0.8403	6.3575
8.00	0.100	0.0130	0.2588	0.0167	0.3689	0.2766	1.0000	14.6193
10.00	0.100	0.0130	0.2588	0.0167	0.4343	0.3136	1.0000	15.8451
12.00	0.100	0.0130	0.2588	0.0167	0.4976	0.3462	1.0000	16.0135
2.00	0.100	0.0130	0.5000	0.0167	0.1148	0.1662	0.3645	10.4300
4.00	0.100	0.0130	0.5000	0.0167	0.1813	0.2663	0.6108	13.1223
6.00	0.100	0.0130	0.5000	0.0167	0.2389	0.3454	0.8403	11.6095
8.00	0.100	0.0130	0.5000	0.0167	0.2917	0.4124	1.0000	17.8543
10.00	0.100	0.0130	0.5000	0.0167	0.3420	0.4699	1.0000	22.5134
12.00	0.100	0.0130	0.5000	0.0167	0.3899	0.5218	1.0000	22.1183
2.00	0.100	0.0130	0.7070	0.0167	0.1026	0.2039	0.3645	10.9101
4.00	0.100	0.0130	0.7070	0.0167	0.1615	0.3258	0.6108	13.7955
6.00	0.100	0.0130	0.7070	0.0167	0.2120	0.4293	0.8403	12.1033
8.00	0.100	0.0130	0.7070	0.0167	0.2585	0.5138	1.0000	19.3149
10.00	0.100	0.0130	0.7070	0.0167	0.3020	0.5890	1.0000	24.3296
12.00	0.100	0.0130	0.7070	0.0167	0.3440	0.6546	1.0000	24.1419
2.00	0.100	0.0130	0.8660	0.0167	0.0961	0.2302	0.3645	11.1576
4.00	0.100	0.0130	0.8660	0.0167	0.1510	0.3728	0.6108	14.1373
6.00	0.100	0.0130	0.8660	0.0167	0.1979	0.4884	0.8403	13.2420
8.00	0.100	0.0130	0.8660	0.0167	0.2406	0.5864	1.0000	20.1375
10.00	0.100	0.0130	0.8660	0.0167	0.2815	0.6714	1.0000	25.3057
12.00	0.100	0.0130	0.8660	0.0167	0.3201	0.7464	1.0000	25.2554
2.00	0.100	0.0130	0.9659	0.0167	0.0928	0.2458	0.3645	11.2304
4.00	0.100	0.0130	0.9659	0.0167	0.1456	0.3991	0.6108	14.3042
6.00	0.100	0.0130	0.9659	0.0167	0.1908	0.5231	0.8403	13.3673
8.00	0.100	0.0130	0.9659	0.0167	0.2321	0.6290	1.0000	20.5572
10.00	0.100	0.0130	0.9659	0.0167	0.2708	0.7224	1.0000	25.8299
12.00	0.100	0.0130	0.9659	0.0167	0.3079	0.8052	1.0000	25.8382
2.00	0.100	0.0130	0.9962	0.0167	0.0919	0.2508	0.3645	11.3161
4.00	0.100	0.0130	0.9962	0.0167	0.1442	0.4068	0.6108	14.3467
6.00	0.100	0.0130	0.9962	0.0167	0.1888	0.5334	0.8403	13.3995
8.00	0.100	0.0130	0.9962	0.0167	0.2296	0.6417	1.0000	20.6752
10.00	0.100	0.0130	0.9962	0.0167	0.2678	0.7374	1.0000	25.9741
12.00	0.100	0.0130	0.9962	0.0167	0.3044	0.8223	1.0000	26.0029

D = 0.15

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH T NORMAL DEPTH. L/D.
2.00	0.150	0.0090	0.2588	0.0500	0.0460	0.1973	0.0770	17.4232
4.00	0.150	0.0090	0.2588	0.0500	0.0710	0.3303	0.1201	29.7884
6.00	0.150	0.0090	0.2588	0.0500	0.0919	0.4433	0.1569	41.1816
8.00	0.150	0.0090	0.2588	0.0500	0.1104	0.5451	0.1901	50.8775
10.00	0.150	0.0090	0.2588	0.0500	0.1278	0.6355	0.2211	59.6272
12.00	0.150	0.0090	0.2588	0.0500	0.1439	0.7215	0.2507	68.5173
2.00	0.150	0.0090	0.5000	0.0500	0.0375	0.2919	0.0770	19.4883
4.00	0.150	0.0090	0.5000	0.0500	0.0577	0.4924	0.1201	33.3104
6.00	0.150	0.0090	0.5000	0.0500	0.0744	0.6659	0.1569	46.0027
8.00	0.150	0.0090	0.5000	0.0500	0.0894	0.8193	0.1901	56.7811
10.00	0.150	0.0090	0.5000	0.0500	0.1032	0.9605	0.2211	66.6033
12.00	0.150	0.0090	0.5000	0.0500	0.1160	1.0943	0.2507	76.4652
2.00	0.150	0.0090	0.7070	0.0500	0.0337	0.3592	0.0770	20.2637
4.00	0.150	0.0090	0.7070	0.0500	0.0518	0.6084	0.1201	34.6491
6.00	0.150	0.0090	0.7070	0.0500	0.0667	0.8244	0.1569	47.8109
8.00	0.150	0.0090	0.7070	0.0500	0.0800	1.0184	0.1901	59.0542
10.00	0.150	0.0090	0.7070	0.0500	0.0923	1.1944	0.2211	69.2561
12.00	0.150	0.0090	0.7070	0.0500	0.1038	1.3606	0.2507	79.5004
2.00	0.150	0.0090	0.8660	0.0500	0.0316	0.4069	0.0770	20.6619
4.00	0.150	0.0090	0.8660	0.0500	0.0486	0.6889	0.1201	35.3224
6.00	0.150	0.0090	0.8660	0.0500	0.0626	0.9354	0.1569	48.7253
8.00	0.150	0.0090	0.8660	0.0500	0.0751	1.1527	0.1901	60.1669
10.00	0.150	0.0090	0.8660	0.0500	0.0865	1.3589	0.2211	70.6539
12.00	0.150	0.0090	0.8660	0.0500	0.0972	1.5482	0.2507	81.0546
2.00	0.150	0.0090	0.9659	0.0500	0.0306	0.4344	0.0770	20.8545
4.00	0.150	0.0090	0.9659	0.0500	0.0470	0.7373	0.1201	35.6612
6.00	0.150	0.0090	0.9659	0.0500	0.0605	0.9988	0.1569	49.1662
8.00	0.150	0.0090	0.9659	0.0500	0.0726	1.2344	0.1901	60.7381
10.00	0.150	0.0090	0.9659	0.0500	0.0836	1.4545	0.2211	71.3176
12.00	0.150	0.0090	0.9659	0.0500	0.0938	1.6614	0.2507	81.8403
2.00	0.150	0.0090	0.9962	0.0500	0.0303	0.4426	0.0770	20.9075
4.00	0.150	0.0090	0.9962	0.0500	0.0465	0.7507	0.1201	35.7451
6.00	0.150	0.0090	0.9962	0.0500	0.0599	1.0189	0.1569	49.2954
8.00	0.150	0.0090	0.9962	0.0500	0.0716	1.2593	0.1901	60.8957
10.00	0.150	0.0090	0.9962	0.0500	0.0827	1.4844	0.2211	71.5117
12.00	0.150	0.0090	0.9962	0.0500	0.0930	1.6917	0.2507	82.0347

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH TO NORMAL DEPTH. L/D.
2.00	0.150	0.0090	0.2586	0.0250	0.0460	0.1973	0.0960	24.4377
4.00	0.150	0.0090	0.2586	0.0250	0.0710	0.3303	0.1508	41.7595
6.00	0.150	0.0090	0.2586	0.0250	0.0919	0.4433	0.1976	56.3045
8.00	0.150	0.0090	0.2586	0.0250	0.1104	0.5451	0.2406	69.0375
10.00	0.150	0.0090	0.2586	0.0250	0.1278	0.6355	0.2810	81.7940
12.00	0.150	0.0090	0.2586	0.0250	0.1439	0.7215	0.3196	92.3869
2.00	0.150	0.0090	0.5000	0.0250	0.0375	0.2919	0.0960	26.1320
4.00	0.150	0.0090	0.5000	0.0250	0.0577	0.4924	0.1508	44.6034
6.00	0.150	0.0090	0.5000	0.0250	0.0744	0.6659	0.1976	60.2949
8.00	0.150	0.0090	0.5000	0.0250	0.0894	0.8193	0.2406	74.5932
10.00	0.150	0.0090	0.5000	0.0250	0.1032	0.9606	0.2810	87.6155
12.00	0.150	0.0090	0.5000	0.0250	0.1160	1.0943	0.3196	99.5453
2.00	0.150	0.0090	0.7070	0.0250	0.0337	0.3592	0.0960	26.8259
4.00	0.150	0.0090	0.7070	0.0250	0.0518	0.6084	0.1508	45.8612
6.00	0.150	0.0090	0.7070	0.0250	0.0667	0.8244	0.1976	61.9342
8.00	0.150	0.0090	0.7070	0.0250	0.0800	1.0184	0.2406	76.6557
10.00	0.150	0.0090	0.7070	0.0250	0.0923	1.1944	0.2810	90.0462
12.00	0.150	0.0090	0.7070	0.0250	0.1038	1.3606	0.3196	102.3110
2.00	0.150	0.0090	0.8660	0.0250	0.0316	0.4069	0.0960	27.1915
4.00	0.150	0.0090	0.8660	0.0250	0.0486	0.6889	0.1508	46.4806
6.00	0.150	0.0090	0.8660	0.0250	0.0626	0.9354	0.1976	62.7912
8.00	0.150	0.0090	0.8660	0.0250	0.0751	1.1527	0.2406	77.6935
10.00	0.150	0.0090	0.8660	0.0250	0.0865	1.3589	0.2810	91.2214
12.00	0.150	0.0090	0.8660	0.0250	0.0972	1.5582	0.3196	103.7694
2.00	0.150	0.0090	0.9659	0.0250	0.0306	0.4344	0.0960	27.3757
4.00	0.150	0.0090	0.9659	0.0250	0.0470	0.7373	0.1508	46.7401
6.00	0.150	0.0090	0.9659	0.0250	0.0605	0.9988	0.1976	63.2053
8.00	0.150	0.0090	0.9659	0.0250	0.0726	1.2344	0.2406	78.2314
10.00	0.150	0.0090	0.9659	0.0250	0.0838	1.4545	0.2810	91.9443
12.00	0.150	0.0090	0.9659	0.0250	0.0938	1.6614	0.3196	104.5150
2.00	0.150	0.0090	0.9962	0.0250	0.0303	0.4426	0.0960	27.4252
4.00	0.150	0.0090	0.9962	0.0250	0.0465	0.7507	0.1508	46.8775
6.00	0.150	0.0090	0.9962	0.0250	0.0599	1.0189	0.1976	63.3259
8.00	0.150	0.0090	0.9962	0.0250	0.0719	1.2593	0.2406	78.3490
10.00	0.150	0.0090	0.9962	0.0250	0.0827	1.4844	0.2810	92.1350
12.00	0.150	0.0090	0.9962	0.0250	0.0930	1.6917	0.3196	104.7014

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH NORMAL DEPTH. L/D.
2.00	0.150	0.0090	0.2588	0.0167	0.0460	0.1973	0.1093	28.3700
4.00	0.150	0.0090	0.2588	0.0167	0.0710	0.3303	0.1725	48.0323
6.00	0.150	0.0090	0.2588	0.0167	0.0919	0.4433	0.2269	65.5376
8.00	0.150	0.0090	0.2588	0.0167	0.1104	0.5451	0.2766	79.5694
10.00	0.150	0.0090	0.2588	0.0167	0.1278	0.6355	0.3240	93.3956
12.00	0.150	0.0090	0.2588	0.0167	0.1439	0.7215	0.3694	106.0670
2.00	0.150	0.0090	0.5000	0.0167	0.0375	0.2919	0.1093	29.9749
4.00	0.150	0.0090	0.5000	0.0167	0.0577	0.4924	0.1725	51.3783
6.00	0.150	0.0090	0.5000	0.0167	0.0744	0.6659	0.2269	69.3157
8.00	0.150	0.0090	0.5000	0.0167	0.0894	0.8193	0.2766	84.2703
10.00	0.150	0.0090	0.5000	0.0167	0.1032	0.9605	0.3240	98.9729
12.00	0.150	0.0090	0.5000	0.0167	0.1160	1.0943	0.3694	112.4399
2.00	0.150	0.0090	0.7070	0.0167	0.0337	0.3592	0.1093	30.6498
4.00	0.150	0.0090	0.7070	0.0167	0.0518	0.6084	0.1725	52.5401
6.00	0.150	0.0090	0.7070	0.0167	0.0667	0.8244	0.2269	70.9064
8.00	0.150	0.0090	0.7070	0.0167	0.0800	1.0184	0.2766	86.2967
10.00	0.150	0.0090	0.7070	0.0167	0.0923	1.1944	0.3240	101.3567
12.00	0.150	0.0090	0.7070	0.0167	0.1038	1.3606	0.3694	115.1521
2.00	0.150	0.0090	0.8660	0.0167	0.0316	0.4069	0.1093	31.0089
4.00	0.150	0.0090	0.8660	0.0167	0.0486	0.6889	0.1725	53.1465
6.00	0.150	0.0090	0.8660	0.0167	0.0626	0.9354	0.2269	71.7455
8.00	0.150	0.0090	0.8660	0.0167	0.0751	1.1527	0.2766	87.3285
10.00	0.150	0.0090	0.8660	0.0167	0.0865	1.3589	0.3240	102.6179
12.00	0.150	0.0090	0.8660	0.0167	0.0972	1.5582	0.3694	116.5944
2.00	0.150	0.0090	0.9659	0.0167	0.0306	0.4344	0.1093	31.1656
4.00	0.150	0.0090	0.9659	0.0167	0.0470	0.7373	0.1725	53.4567
6.00	0.150	0.0090	0.9659	0.0167	0.0605	0.9985	0.2269	72.1526
8.00	0.150	0.0090	0.9659	0.0167	0.0726	1.2344	0.2766	87.9643
10.00	0.150	0.0090	0.9659	0.0167	0.0836	1.4545	0.3240	103.2402
12.00	0.150	0.0090	0.9659	0.0167	0.0938	1.6614	0.3694	117.3356
2.00	0.150	0.0090	0.9962	0.0167	0.0303	0.4426	0.1093	31.2345
4.00	0.150	0.0090	0.9962	0.0167	0.0465	0.7507	0.1725	53.5303
6.00	0.150	0.0090	0.9962	0.0167	0.0599	1.0189	0.2269	72.2739
8.00	0.150	0.0090	0.9962	0.0167	0.0716	1.2593	0.2766	88.0166
10.00	0.150	0.0090	0.9962	0.0167	0.0827	1.4844	0.3240	103.4260
12.00	0.150	0.0090	0.9962	0.0167	0.0930	1.6917	0.3694	117.5204

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH TO NORMAL DEPTH. L/D.
2.00	0.150	0.0090	0.2588	0.0125	0.0460	0.1973	0.1201	30.8745
4.00	0.150	0.0090	0.2588	0.0125	0.0710	0.3303	0.1901	52.7295
6.00	0.150	0.0090	0.2588	0.0125	0.0919	0.4433	0.2507	70.8920
8.00	0.150	0.0090	0.2588	0.0125	0.1104	0.5451	0.3064	86.1149
10.00	0.150	0.0090	0.2588	0.0125	0.1278	0.6355	0.3596	100.8511
12.00	0.150	0.0090	0.2588	0.0125	0.1439	0.7215	0.4104	115.3210
2.00	0.150	0.0090	0.5000	0.0125	0.0375	0.2919	0.1201	32.4492
4.00	0.150	0.0090	0.5000	0.0125	0.0577	0.4924	0.1901	55.4299
6.00	0.150	0.0090	0.5000	0.0125	0.0744	0.6659	0.2507	74.6105
8.00	0.150	0.0090	0.5000	0.0125	0.0894	0.8193	0.3064	90.7370
10.00	0.150	0.0090	0.5000	0.0125	0.1032	0.9606	0.3596	106.3343
12.00	0.150	0.0090	0.5000	0.0125	0.1160	1.0943	0.4104	119.6243
2.00	0.150	0.0090	0.7070	0.0125	0.0337	0.3592	0.1201	33.1203
4.00	0.150	0.0090	0.7070	0.0125	0.0516	0.6084	0.1901	56.5863
6.00	0.150	0.0090	0.7070	0.0125	0.0667	0.8244	0.2507	76.1970
8.00	0.150	0.0090	0.7070	0.0125	0.0800	1.0184	0.3064	92.7533
10.00	0.150	0.0090	0.7070	0.0125	0.0923	1.1944	0.3596	108.7063
12.00	0.150	0.0090	0.7070	0.0125	0.1038	1.3606	0.4104	122.3333
2.00	0.150	0.0090	0.8660	0.0125	0.0316	0.4069	0.1201	33.4793
4.00	0.150	0.0090	0.8660	0.0125	0.0486	0.6889	0.1901	57.1957
6.00	0.150	0.0090	0.8660	0.0125	0.0626	0.9354	0.2507	76.7069
8.00	0.150	0.0090	0.8660	0.0125	0.0751	1.1527	0.3064	93.0463
10.00	0.150	0.0090	0.8660	0.0125	0.0865	1.3589	0.3596	107.9147
12.00	0.150	0.0090	0.8660	0.0125	0.0972	1.5482	0.4104	81.0842
2.00	0.150	0.0090	0.9659	0.0125	0.0306	0.4344	0.1201	33.6552
4.00	0.150	0.0090	0.9659	0.0125	0.0470	0.7373	0.1901	56.8552
6.00	0.150	0.0090	0.9659	0.0125	0.0605	0.9988	0.2507	75.5101
8.00	0.150	0.0090	0.9659	0.0125	0.0726	1.2344	0.3064	97.4525
10.00	0.150	0.0090	0.9659	0.0125	0.0836	1.4545	0.3596	109.4157
12.00	0.150	0.0090	0.9659	0.0125	0.0938	1.6614	0.4104	50.1434
2.00	0.150	0.0090	0.9962	0.0125	0.0303	0.4426	0.1201	33.7053
4.00	0.150	0.0090	0.9962	0.0125	0.0465	0.7507	0.1901	56.9372
6.00	0.150	0.0090	0.9962	0.0125	0.0599	1.0189	0.2507	75.6747
8.00	0.150	0.0090	0.9962	0.0125	0.0718	1.2593	0.3064	90.0951
10.00	0.150	0.0090	0.9962	0.0125	0.0827	1.4844	0.3596	104.7583
12.00	0.150	0.0090	0.9962	0.0125	0.0930	1.6917	0.4104	52.2575

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH T NORMAL DEPTH. L/D.
2.00	0.150	0.0120	0.2588	0.0500	0.0550	0.1413	0.0925	11.5886
4.00	0.150	0.0120	0.2588	0.0500	0.0951	0.2350	0.1449	20.1100
6.00	0.150	0.0120	0.2588	0.0500	0.1104	0.3139	0.1901	27.0465
8.00	0.150	0.0120	0.2588	0.0500	0.1332	0.3833	0.2311	33.9969
10.00	0.150	0.0120	0.2588	0.0500	0.1544	0.4454	0.2698	40.0062
12.00	0.150	0.0120	0.2588	0.0500	0.1742	0.5039	0.3064	45.1237
2.00	0.150	0.0120	0.5000	0.0500	0.0446	0.2071	0.0925	13.2442
4.00	0.150	0.0120	0.5000	0.0500	0.0692	0.3472	0.1449	22.4141
6.00	0.150	0.0120	0.5000	0.0500	0.0894	0.4667	0.1901	30.7705
8.00	0.150	0.0120	0.5000	0.0500	0.1075	0.5739	0.2311	37.3791
10.00	0.150	0.0120	0.5000	0.0500	0.1244	0.6693	0.2698	44.6247
12.00	0.150	0.0120	0.5000	0.0500	0.1400	0.7605	0.3064	50.3058
2.00	0.150	0.0120	0.7070	0.0500	0.0403	0.2546	0.0925	13.7751
4.00	0.150	0.0120	0.7070	0.0500	0.0620	0.4290	0.1449	23.3326
6.00	0.150	0.0120	0.7070	0.0500	0.0800	0.5781	0.1901	32.0156
8.00	0.150	0.0120	0.7070	0.0500	0.0963	0.7099	0.2311	39.3942
10.00	0.150	0.0120	0.7070	0.0500	0.1110	0.8334	0.2698	46.4221
12.00	0.150	0.0120	0.7070	0.0500	0.1251	0.9446	0.3064	52.3635
2.00	0.150	0.0120	0.8660	0.0500	0.0378	0.2873	0.0925	14.0445
4.00	0.150	0.0120	0.8660	0.0500	0.0581	0.4853	0.1449	23.7953
6.00	0.150	0.0120	0.8660	0.0500	0.0751	0.6533	0.1901	32.6333
8.00	0.150	0.0120	0.8660	0.0500	0.0901	0.8064	0.2311	40.1849
10.00	0.150	0.0120	0.8660	0.0500	0.1041	0.9453	0.2698	47.3052
12.00	0.150	0.0120	0.8660	0.0500	0.1170	1.0765	0.3064	53.4451
2.00	0.150	0.0120	0.9659	0.0500	0.0365	0.3073	0.0925	14.1313
4.00	0.150	0.0120	0.9659	0.0500	0.0562	0.5188	0.1449	24.0203
6.00	0.150	0.0120	0.9659	0.0500	0.0726	0.6991	0.1901	32.9491
8.00	0.150	0.0120	0.9659	0.0500	0.0871	0.8625	0.2311	40.5719
10.00	0.150	0.0120	0.9659	0.0500	0.1004	1.0138	0.2698	47.8303
12.00	0.150	0.0120	0.9659	0.0500	0.1130	1.1528	0.3064	53.9725
2.00	0.150	0.0120	0.9962	0.0500	0.0362	0.3123	0.0925	14.2135
4.00	0.150	0.0120	0.9962	0.0500	0.0557	0.5277	0.1449	24.0534
6.00	0.150	0.0120	0.9962	0.0500	0.0715	0.7131	0.1901	33.0313
8.00	0.150	0.0120	0.9962	0.0500	0.0862	0.8792	0.2311	40.8772
10.00	0.150	0.0120	0.9962	0.0500	0.0994	1.0333	0.2698	47.9510
12.00	0.150	0.0120	0.9962	0.0500	0.1119	1.1751	0.3064	54.1153

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH TO NORMAL DEPTH. L/D.
2.00	0.150	0.0120	0.2588	0.0250	0.0550	0.1413	0.1155	15.7823
4.00	0.150	0.0120	0.2588	0.0250	0.0851	0.2350	0.1825	26.7465
6.00	0.150	0.0120	0.2588	0.0250	0.1104	0.3139	0.2406	36.1726
8.00	0.150	0.0120	0.2588	0.0250	0.1332	0.3833	0.2942	44.5894
10.00	0.150	0.0120	0.2588	0.0250	0.1544	0.4454	0.3445	51.4940
12.00	0.150	0.0120	0.2588	0.0250	0.1742	0.5039	0.3933	58.5004
2.00	0.150	0.0120	0.5000	0.0250	0.0448	0.2071	0.1155	16.9157
4.00	0.150	0.0120	0.5000	0.0250	0.0692	0.3472	0.1825	26.6935
6.00	0.150	0.0120	0.5000	0.0250	0.0894	0.4667	0.2406	36.8135
8.00	0.150	0.0120	0.5000	0.0250	0.1075	0.5739	0.2942	47.8755
10.00	0.150	0.0120	0.5000	0.0250	0.1244	0.6693	0.3445	55.3709
12.00	0.150	0.0120	0.5000	0.0250	0.1400	0.7605	0.3933	62.7953
2.00	0.150	0.0120	0.7070	0.0250	0.0403	0.2546	0.1155	17.4029
4.00	0.150	0.0120	0.7070	0.0250	0.0620	0.4290	0.1825	29.5321
6.00	0.150	0.0120	0.7070	0.0250	0.0800	0.5781	0.2406	39.9807
8.00	0.150	0.0120	0.7070	0.0250	0.0963	0.7099	0.2942	49.2574
10.00	0.150	0.0120	0.7070	0.0250	0.1110	0.8334	0.3445	57.0553
12.00	0.150	0.0120	0.7070	0.0250	0.1251	0.9448	0.3933	64.8935
2.00	0.150	0.0120	0.8660	0.0250	0.0378	0.2873	0.1155	17.6544
4.00	0.150	0.0120	0.8660	0.0250	0.0581	0.4853	0.1825	29.9881
6.00	0.150	0.0120	0.8660	0.0250	0.0751	0.6533	0.2406	40.5420
8.00	0.150	0.0120	0.8660	0.0250	0.0901	0.8064	0.2942	50.0140
10.00	0.150	0.0120	0.8660	0.0250	0.1041	0.9453	0.3445	57.9555
12.00	0.150	0.0120	0.8660	0.0250	0.1170	1.0765	0.3933	65.9167
2.00	0.150	0.0120	0.9659	0.0250	0.0365	0.3073	0.1155	17.7543
4.00	0.150	0.0120	0.9659	0.0250	0.0562	0.5188	0.1825	30.1355
6.00	0.150	0.0120	0.9659	0.0250	0.0726	0.6991	0.2406	40.8431
8.00	0.150	0.0120	0.9659	0.0250	0.0871	0.8625	0.2942	50.3555
10.00	0.150	0.0120	0.9659	0.0250	0.1004	1.0136	0.3445	58.4079
12.00	0.150	0.0120	0.9659	0.0250	0.1130	1.1528	0.3933	66.4254
2.00	0.150	0.0120	0.9962	0.0250	0.0364	0.3123	0.1155	17.7150
4.00	0.150	0.0120	0.9962	0.0250	0.0557	0.5277	0.1825	30.2403
6.00	0.150	0.0120	0.9962	0.0250	0.0718	0.7131	0.2406	40.9296
8.00	0.150	0.0120	0.9962	0.0250	0.0862	0.8792	0.2942	50.4553
10.00	0.150	0.0120	0.9962	0.0250	0.0994	1.0333	0.3445	58.5007
12.00	0.150	0.0120	0.9962	0.0250	0.1119	1.1751	0.3933	66.5555

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO M/D.	ENTRY ENERGY M.	NORMAL DEPTH M/D.	PIPE LENGTH T NORMAL DEPTH. L/D.
2.00	0.150	0.0120	0.2568	0.0125	0.0550	0.1413	0.1449	10.0761
4.00	0.150	0.0120	0.2568	0.0125	0.0851	0.2350	0.2311	30.4916
6.00	0.150	0.0120	0.2568	0.0125	0.1104	0.3139	0.3064	40.2251
8.00	0.150	0.0120	0.2568	0.0125	0.1332	0.3833	0.3767	46.6052
10.00	0.150	0.0120	0.2568	0.0125	0.1544	0.4454	0.4436	55.6009
12.00	0.150	0.0120	0.2568	0.0125	0.1742	0.5039	0.5063	61.0548
2.00	0.150	0.0120	0.5000	0.0125	0.0448	0.2071	0.1449	19.1021
4.00	0.150	0.0120	0.5000	0.0125	0.0692	0.3472	0.2311	32.3554
6.00	0.150	0.0120	0.5000	0.0125	0.0894	0.4667	0.3064	42.7044
8.00	0.150	0.0120	0.5000	0.0125	0.1075	0.5739	0.3767	51.8045
10.00	0.150	0.0120	0.5000	0.0125	0.1244	0.6693	0.4436	59.3907
12.00	0.150	0.0120	0.5000	0.0125	0.1400	0.7605	0.5063	66.0021
2.00	0.150	0.0120	0.7070	0.0125	0.0403	0.2546	0.1449	19.6425
4.00	0.150	0.0120	0.7070	0.0125	0.0620	0.4290	0.2311	33.1877
6.00	0.150	0.0120	0.7070	0.0125	0.0800	0.5781	0.3064	43.9230
8.00	0.150	0.0120	0.7070	0.0125	0.0963	0.7099	0.3767	53.2092
10.00	0.150	0.0120	0.7070	0.0125	0.1110	0.8334	0.4436	60.8585
12.00	0.150	0.0120	0.7070	0.0125	0.1251	0.9448	0.5063	67.5716
2.00	0.150	0.0120	0.8660	0.0125	0.0378	0.2873	0.1449	19.8956
4.00	0.150	0.0120	0.8660	0.0125	0.0581	0.4853	0.2311	39.1313
6.00	0.150	0.0120	0.8660	0.0125	0.0751	0.6533	0.3064	45.0355
8.00	0.150	0.0120	0.8660	0.0125	0.0901	0.8064	0.3767	51.0990
10.00	0.150	0.0120	0.8660	0.0125	0.1041	0.9453	0.4436	60.1597
12.00	0.150	0.0120	0.8660	0.0125	0.1170	1.0765	0.5063	67.7517
2.00	0.150	0.0120	0.9659	0.0125	0.0365	0.3073	0.1449	20.0315
4.00	0.150	0.0120	0.9659	0.0125	0.0562	0.5186	0.2311	104.5613
6.00	0.150	0.0120	0.9659	0.0125	0.0726	0.6991	0.3064	45.9495
8.00	0.150	0.0120	0.9659	0.0125	0.0871	0.8625	0.3767	49.7063
10.00	0.150	0.0120	0.9659	0.0125	0.1004	1.0138	0.4436	59.7624
12.00	0.150	0.0120	0.9659	0.0125	0.1130	1.1528	0.5063	67.6376
2.00	0.150	0.0120	0.9962	0.0125	0.0362	0.3123	0.1449	20.1151
4.00	0.150	0.0120	0.9962	0.0125	0.0557	0.5277	0.2311	120.9570
6.00	0.150	0.0120	0.9962	0.0125	0.0718	0.7131	0.3064	46.2104
8.00	0.150	0.0120	0.9962	0.0125	0.0862	0.8792	0.3767	49.3137
10.00	0.150	0.0120	0.9962	0.0125	0.0994	1.0333	0.4436	59.6503
12.00	0.150	0.0120	0.9962	0.0125	0.1119	1.1751	0.5063	67.3596

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH TO NORMAL DEPTH. L/D.
2.00	0.150	0.0120	0.2500	0.0167	0.0550	0.1413	0.1320	17.7316
4.00	0.150	0.0120	0.2500	0.0167	0.0851	0.2350	0.2094	29.7515
6.00	0.150	0.0120	0.2500	0.0167	0.1104	0.3139	0.2766	39.3033
8.00	0.150	0.0120	0.2500	0.0167	0.1332	0.3833	0.3391	47.3673
10.00	0.150	0.0120	0.2500	0.0167	0.1544	0.4454	0.3937	55.0491
12.00	0.150	0.0120	0.2500	0.0167	0.1742	0.5039	0.4558	62.0547
2.00	0.150	0.0120	0.5000	0.0167	0.0446	0.2071	0.1320	10.8156
4.00	0.150	0.0120	0.5000	0.0167	0.0692	0.3472	0.2094	31.6205
6.00	0.150	0.0120	0.5000	0.0167	0.0894	0.4667	0.2766	41.9321
8.00	0.150	0.0120	0.5000	0.0167	0.1075	0.5739	0.3391	51.0969
10.00	0.150	0.0120	0.5000	0.0167	0.1244	0.6693	0.3937	59.3319
12.00	0.150	0.0120	0.5000	0.0167	0.1400	0.7605	0.4558	66.3967
2.00	0.150	0.0120	0.7070	0.0167	0.0403	0.2546	0.1320	19.2385
4.00	0.150	0.0120	0.7070	0.0167	0.0620	0.4290	0.2094	32.4446
6.00	0.150	0.0120	0.7070	0.0167	0.0800	0.5781	0.2766	43.0659
8.00	0.150	0.0120	0.7070	0.0167	0.0963	0.7099	0.3391	52.4905
10.00	0.150	0.0120	0.7070	0.0167	0.1110	0.8334	0.3937	61.0103
12.00	0.150	0.0120	0.7070	0.0167	0.1251	0.9448	0.4558	68.2953
2.00	0.150	0.0120	0.8660	0.0167	0.0378	0.2873	0.1320	19.5303
4.00	0.150	0.0120	0.8660	0.0167	0.0581	0.4853	0.2094	32.8744
6.00	0.150	0.0120	0.8660	0.0167	0.0751	0.6533	0.2766	43.6500
8.00	0.150	0.0120	0.8660	0.0167	0.0901	0.8064	0.3391	53.2422
10.00	0.150	0.0120	0.8660	0.0167	0.1041	0.9453	0.3937	61.8883
12.00	0.150	0.0120	0.8660	0.0167	0.1170	1.0765	0.4558	69.3322
2.00	0.150	0.0120	0.9659	0.0167	0.0365	0.3073	0.1320	19.6048
4.00	0.150	0.0120	0.9659	0.0167	0.0562	0.5188	0.2094	33.0931
6.00	0.150	0.0120	0.9659	0.0167	0.0726	0.6991	0.2766	43.9940
8.00	0.150	0.0120	0.9659	0.0167	0.0871	0.8625	0.3391	53.8150
10.00	0.150	0.0120	0.9659	0.0167	0.1004	1.0138	0.3937	62.3740
12.00	0.150	0.0120	0.9659	0.0167	0.1130	1.1529	0.4558	70.8171
2.00	0.150	0.0120	0.9962	0.0167	0.0362	0.3123	0.1320	19.6993
4.00	0.150	0.0120	0.9962	0.0167	0.0557	0.5277	0.2094	33.1470
6.00	0.150	0.0120	0.9962	0.0167	0.0716	0.7131	0.2766	44.0419
8.00	0.150	0.0120	0.9962	0.0167	0.0862	0.8792	0.3391	53.9703
10.00	0.150	0.0120	0.9962	0.0167	0.0994	1.0333	0.3937	62.5243
12.00	0.150	0.0120	0.9962	0.0167	0.1119	1.1751	0.4558	71.0326

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH T NORMAL DEPTH. L/D.
2.00	0.150	0.0150	0.2568	0.0500	0.0633	0.1100	0.1068	8.6502
4.00	0.150	0.0150	0.2586	0.0500	0.0982	0.1618	0.1681	14.6265
6.00	0.150	0.0150	0.2586	0.0500	0.1278	0.2411	0.2211	19.7675
8.00	0.150	0.0150	0.2588	0.0500	0.1544	0.2934	0.2698	24.4134
10.00	0.150	0.0150	0.2586	0.0500	0.1791	0.3408	0.3157	28.5509
12.00	0.150	0.0150	0.2586	0.0500	0.2025	0.3839	0.3596	32.2764
2.00	0.150	0.0150	0.5000	0.0500	0.0515	0.1597	0.1068	9.6042
4.00	0.150	0.0150	0.5000	0.0500	0.0797	0.2659	0.1681	16.2471
6.00	0.150	0.0150	0.5000	0.0500	0.1032	0.3557	0.2211	21.9764
8.00	0.150	0.0150	0.5000	0.0500	0.1244	0.4351	0.2698	27.1350
10.00	0.150	0.0150	0.5000	0.0500	0.1439	0.5076	0.3157	31.7375
12.00	0.150	0.0150	0.5000	0.0500	0.1622	0.5752	0.3596	35.9110
2.00	0.150	0.0150	0.7070	0.0500	0.0462	0.1953	0.1068	9.9902
4.00	0.150	0.0150	0.7070	0.0500	0.0714	0.3271	0.1681	16.9140
6.00	0.150	0.0150	0.7070	0.0500	0.0923	0.4389	0.2211	22.8807
8.00	0.150	0.0150	0.7070	0.0500	0.1110	0.5394	0.2698	28.2650
10.00	0.150	0.0150	0.7070	0.0500	0.1283	0.6309	0.3157	33.0702
12.00	0.150	0.0150	0.7070	0.0500	0.1447	0.7146	0.3596	37.4150
2.00	0.150	0.0150	0.8660	0.0500	0.0434	0.2201	0.1068	10.1553
4.00	0.150	0.0150	0.8660	0.0500	0.0670	0.3694	0.1681	17.2543
6.00	0.150	0.0150	0.8660	0.0500	0.0865	0.4975	0.2211	23.3529
8.00	0.150	0.0150	0.8660	0.0500	0.1041	0.6106	0.2698	28.8376
10.00	0.150	0.0150	0.8660	0.0500	0.1202	0.7151	0.3157	33.7495
12.00	0.150	0.0150	0.8660	0.0500	0.1354	0.8114	0.3596	38.1936
2.00	0.150	0.0150	0.9659	0.0500	0.0420	0.2350	0.1068	10.2894
4.00	0.150	0.0150	0.9659	0.0500	0.0646	0.3953	0.1681	17.4305
6.00	0.150	0.0150	0.9659	0.0500	0.0836	0.5317	0.2211	23.5653
8.00	0.150	0.0150	0.9659	0.0500	0.1004	0.6542	0.2698	29.1343
10.00	0.150	0.0150	0.9659	0.0500	0.1160	0.7652	0.3157	34.0605
12.00	0.150	0.0150	0.9659	0.0500	0.1307	0.8670	0.3596	38.5763
2.00	0.150	0.0150	0.9962	0.0500	0.0415	0.2397	0.1068	10.3100
4.00	0.150	0.0150	0.9962	0.0500	0.0640	0.4026	0.1681	17.4700
6.00	0.150	0.0150	0.9962	0.0500	0.0827	0.5423	0.2211	23.6525
8.00	0.150	0.0150	0.9962	0.0500	0.0994	0.6667	0.2698	29.2125
10.00	0.150	0.0150	0.9962	0.0500	0.1148	0.7811	0.3157	34.1853
12.00	0.150	0.0150	0.9962	0.0500	0.1293	0.8869	0.3596	38.6973

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO M/D.	ENTRY ENERGY M.	NORMAL DEPTH M/D.	PIPE LENGTH NORMAL DEPTH L/D.
2.00	0.150	0.0150	0.2588	0.0250	0.0633	0.1100	0.1337	10.7377
4.00	0.150	0.0150	0.2588	0.0250	0.0962	0.1819	0.2123	16.0667
6.00	0.150	0.0150	0.2588	0.0250	0.1278	0.2411	0.2810	24.1442
8.00	0.150	0.0150	0.2588	0.0250	0.1544	0.2934	0.3445	29.2015
10.00	0.150	0.0150	0.2588	0.0250	0.1791	0.3408	0.4050	33.7547
12.00	0.150	0.0150	0.2588	0.0250	0.2025	0.3839	0.4631	37.5657
2.00	0.150	0.0150	0.5000	0.0250	0.0515	0.1597	0.1337	11.5561
4.00	0.150	0.0150	0.5000	0.0250	0.0797	0.2659	0.2123	19.4694
6.00	0.150	0.0150	0.5000	0.0250	0.1032	0.3557	0.2810	26.0619
8.00	0.150	0.0150	0.5000	0.0250	0.1244	0.4351	0.3445	31.5812
10.00	0.150	0.0150	0.5000	0.0250	0.1439	0.5076	0.4050	36.5536
12.00	0.150	0.0150	0.5000	0.0250	0.1622	0.5752	0.4631	40.7790
2.00	0.150	0.0150	0.7070	0.0250	0.0462	0.1953	0.1337	11.9140
4.00	0.150	0.0150	0.7070	0.0250	0.0714	0.3271	0.2123	20.0905
6.00	0.150	0.0150	0.7070	0.0250	0.0923	0.4389	0.2810	26.9079
8.00	0.150	0.0150	0.7070	0.0250	0.1110	0.5394	0.3445	32.5475
10.00	0.150	0.0150	0.7070	0.0250	0.1283	0.6309	0.4050	37.6146
12.00	0.150	0.0150	0.7070	0.0250	0.1447	0.7146	0.4631	42.2100
2.00	0.150	0.0150	0.8660	0.0250	0.0434	0.2201	0.1337	12.1030
4.00	0.150	0.0150	0.8660	0.0250	0.0670	0.3694	0.2123	20.4161
6.00	0.150	0.0150	0.8660	0.0250	0.0865	0.4975	0.2810	27.3614
8.00	0.150	0.0150	0.8660	0.0250	0.1041	0.6106	0.3445	33.2014
10.00	0.150	0.0150	0.8660	0.0250	0.1202	0.7151	0.4050	38.4704
12.00	0.150	0.0150	0.8660	0.0250	0.1354	0.8114	0.4631	42.9690
2.00	0.150	0.0150	0.9659	0.0250	0.0420	0.2350	0.1337	12.2000
4.00	0.150	0.0150	0.9659	0.0250	0.0646	0.3953	0.2123	20.5668
6.00	0.150	0.0150	0.9659	0.0250	0.0836	0.5317	0.2810	27.5272
8.00	0.150	0.0150	0.9659	0.0250	0.1004	0.6542	0.3445	33.4921
10.00	0.150	0.0150	0.9659	0.0250	0.1160	0.7652	0.4050	38.5004
12.00	0.150	0.0150	0.9659	0.0250	0.1307	0.8678	0.4631	43.3456
2.00	0.150	0.0150	0.9962	0.0250	0.0415	0.2397	0.1337	12.2270
4.00	0.150	0.0150	0.9962	0.0250	0.0640	0.4026	0.2123	20.6316
6.00	0.150	0.0150	0.9962	0.0250	0.0827	0.5423	0.2810	27.6028
8.00	0.150	0.0150	0.9962	0.0250	0.0994	0.6667	0.3445	33.5693
10.00	0.150	0.0150	0.9962	0.0250	0.1146	0.7811	0.4050	38.7039
12.00	0.150	0.0150	0.9962	0.0250	0.1293	0.8869	0.4631	43.4684

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH NORMAL DEPT L/D.
2.00	0.150	0.0150	0.2586	0.0167	0.0633	0.1100	0.1527	11.0444
4.00	0.150	0.0150	0.2586	0.0167	0.0962	0.1818	0.2438	16.3513
6.00	0.150	0.0150	0.2586	0.0167	0.1276	0.2411	0.3240	24.0826
8.00	0.150	0.0150	0.2586	0.0167	0.1544	0.2934	0.3967	26.7185
10.00	0.150	0.0150	0.2586	0.0167	0.1791	0.3408	0.4700	32.5011
12.00	0.150	0.0150	0.2586	0.0167	0.2025	0.3839	0.5386	35.4802
2.00	0.150	0.0150	0.5000	0.0167	0.0515	0.1597	0.1527	11.8447
4.00	0.150	0.0150	0.5000	0.0167	0.0797	0.2659	0.2438	19.7270
6.00	0.150	0.0150	0.5000	0.0167	0.1032	0.3557	0.3240	25.9749
8.00	0.150	0.0150	0.5000	0.0167	0.1244	0.4351	0.3967	31.0713
10.00	0.150	0.0150	0.5000	0.0167	0.1439	0.5075	0.4700	35.2815
12.00	0.150	0.0150	0.5000	0.0167	0.1622	0.5752	0.5386	38.6815
2.00	0.150	0.0150	0.7070	0.0167	0.0462	0.1953	0.1527	12.2030
4.00	0.150	0.0150	0.7070	0.0167	0.0714	0.3271	0.2438	20.3510
6.00	0.150	0.0150	0.7070	0.0167	0.0923	0.4389	0.3240	26.8269
8.00	0.150	0.0150	0.7070	0.0167	0.1110	0.5394	0.3967	32.1434
10.00	0.150	0.0150	0.7070	0.0167	0.1283	0.6309	0.4700	36.5606
12.00	0.150	0.0150	0.7070	0.0167	0.1447	0.7146	0.5386	40.1368
2.00	0.150	0.0150	0.8660	0.0167	0.0434	0.2201	0.1527	12.3939
4.00	0.150	0.0150	0.8660	0.0167	0.0670	0.3694	0.2438	20.6810
6.00	0.150	0.0150	0.8660	0.0167	0.0865	0.4975	0.3240	27.2899
8.00	0.150	0.0150	0.8660	0.0167	0.1041	0.6106	0.3967	32.7123
10.00	0.150	0.0150	0.8660	0.0167	0.1202	0.7151	0.4700	37.2303
12.00	0.150	0.0150	0.8660	0.0167	0.1354	0.8114	0.5386	40.9677
2.00	0.150	0.0150	0.9659	0.0167	0.0420	0.2350	0.1527	12.4929
4.00	0.150	0.0150	0.9659	0.0167	0.0646	0.3953	0.2438	20.8547
6.00	0.150	0.0150	0.9659	0.0167	0.0836	0.5317	0.3240	27.5204
8.00	0.150	0.0150	0.9659	0.0167	0.1004	0.6542	0.3967	33.2455
10.00	0.150	0.0150	0.9659	0.0167	0.1160	0.7652	0.4700	37.9540
12.00	0.150	0.0150	0.9659	0.0167	0.1307	0.8678	0.5386	41.8034
2.00	0.150	0.0150	0.9962	0.0167	0.0415	0.2397	0.1527	12.5218
4.00	0.150	0.0150	0.9962	0.0167	0.0640	0.4026	0.2438	20.9003
6.00	0.150	0.0150	0.9962	0.0167	0.0827	0.5423	0.3240	27.5877
8.00	0.150	0.0150	0.9962	0.0167	0.0994	0.6667	0.3967	33.3315
10.00	0.150	0.0150	0.9962	0.0167	0.1148	0.7811	0.4700	38.0021
12.00	0.150	0.0150	0.9962	0.0167	0.1293	0.8869	0.5386	41.8043

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN ENTRY RATIO	FLOW DEPTH H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH T NORMAL DEPTH. L/D.
2.00	0.150	0.0150	0.2588	0.0125		0.0633	0.1100	0.1681	10.3052
4.00	0.150	0.0150	0.2588	0.0125		0.0982	0.1818	0.2698	16.9455
6.00	0.150	0.0150	0.2588	0.0125		0.1278	0.2411	0.3596	21.6604
8.00	0.150	0.0150	0.2588	0.0125		0.1544	0.2934	0.4436	24.9771
10.00	0.150	0.0150	0.2588	0.0125		0.1791	0.3405	0.5239	27.5034
12.00	0.150	0.0150	0.2588	0.0125		0.2025	0.3839	0.6021	30.1773
2.00	0.150	0.0150	0.5000	0.0125		0.0515	0.1597	0.1681	11.1153
4.00	0.150	0.0150	0.5000	0.0125		0.0797	0.2659	0.2698	18.3309
6.00	0.150	0.0150	0.5000	0.0125		0.1032	0.3557	0.3596	23.6006
8.00	0.150	0.0150	0.5000	0.0125		0.1244	0.4351	0.4436	27.3473
10.00	0.150	0.0150	0.5000	0.0125		0.1439	0.5076	0.5239	30.3022
12.00	0.150	0.0150	0.5000	0.0125		0.1622	0.5752	0.6021	32.6562
2.00	0.150	0.0150	0.7070	0.0125		0.0462	0.1953	0.1681	11.4820
4.00	0.150	0.0150	0.7070	0.0125		0.0714	0.3271	0.2698	18.9751
6.00	0.150	0.0150	0.7070	0.0125		0.0923	0.4389	0.3596	24.4751
8.00	0.150	0.0150	0.7070	0.0125		0.1110	0.5394	0.4436	28.4426
10.00	0.150	0.0150	0.7070	0.0125		0.1283	0.6309	0.5239	31.6655
12.00	0.150	0.0150	0.7070	0.0125		0.1447	0.7146	0.6021	33.9417
2.00	0.150	0.0150	0.8660	0.0125		0.0434	0.2201	0.1681	11.6752
4.00	0.150	0.0150	0.8660	0.0125		0.0670	0.3694	0.2698	19.2587
6.00	0.150	0.0150	0.8660	0.0125		0.0865	0.4975	0.3596	24.8705
8.00	0.150	0.0150	0.8660	0.0125		0.1041	0.6106	0.4436	29.0154
10.00	0.150	0.0150	0.8660	0.0125		0.1202	0.7151	0.5239	32.3305
12.00	0.150	0.0150	0.8660	0.0125		0.1354	0.8114	0.6021	34.8396
2.00	0.150	0.0150	0.9659	0.0125		0.0420	0.2350	0.1681	11.8371
4.00	0.150	0.0150	0.9659	0.0125		0.0648	0.3953	0.2698	19.3509
6.00	0.150	0.0150	0.9659	0.0125		0.0836	0.5317	0.3596	25.0666
8.00	0.150	0.0150	0.9659	0.0125		0.1004	0.6542	0.4436	29.3223
10.00	0.150	0.0150	0.9659	0.0125		0.1160	0.7652	0.5239	32.7023
12.00	0.150	0.0150	0.9659	0.0125		0.1307	0.8675	0.6021	34.9921
2.00	0.150	0.0150	0.9962	0.0125		0.0415	0.2397	0.1681	11.9058
4.00	0.150	0.0150	0.9962	0.0125		0.0640	0.4026	0.2698	19.3750
6.00	0.150	0.0150	0.9962	0.0125		0.0827	0.5423	0.3596	25.1246
8.00	0.150	0.0150	0.9962	0.0125		0.0994	0.6667	0.4436	29.4033
10.00	0.150	0.0150	0.9962	0.0125		0.1148	0.7811	0.5239	32.8050
12.00	0.150	0.0150	0.9962	0.0125		0.1293	0.8869	0.6021	35.1037

DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH TO NORMAL DEPTH. L/D.
0 0.150	0.0140	0.2566	0.0500	0.0710	0.0906	0.1201	6.4405
0 0.150	0.0130	0.2566	0.0500	0.1104	0.1487	0.1901	11.0069
0 0.150	0.0140	0.2566	0.0500	0.1439	0.1966	0.2507	14.7576
0 0.150	0.0130	0.2566	0.0500	0.1742	0.2385	0.3064	17.8602
0 0.150	0.0150	0.2566	0.0500	0.2025	0.2759	0.3596	20.9155
0 0.150	0.0140	0.2566	0.0500	0.2294	0.3100	0.4104	23.4247
0 0.150	0.0130	0.5000	0.0500	0.0577	0.1296	0.1201	7.1413
0 0.150	0.0130	0.5000	0.0500	0.0894	0.2149	0.1901	12.1955
0 0.150	0.0130	0.5000	0.0500	0.1160	0.2866	0.2507	16.3815
0 0.150	0.0150	0.5000	0.0500	0.1400	0.3497	0.3064	19.9495
0 0.150	0.0140	0.5000	0.0500	0.1622	0.4069	0.3596	23.2511
0 0.150	0.0130	0.5000	0.0500	0.1835	0.4582	0.4104	26.0657
0 0.150	0.0130	0.7070	0.0500	0.0518	0.1579	0.1201	7.4375
0 0.150	0.0130	0.7070	0.0500	0.0800	0.2636	0.1901	12.7054
0 0.150	0.0130	0.7070	0.0500	0.1036	0.3518	0.2507	17.0650
0 0.150	0.0130	0.7070	0.0500	0.1251	0.4303	0.3064	20.7004
0 0.150	0.0140	0.7070	0.0500	0.1447	0.5028	0.3596	24.2576
0 0.150	0.0130	0.7070	0.0500	0.1632	0.5688	0.4104	27.2255
0 0.150	0.0130	0.8660	0.0500	0.0486	0.1777	0.1201	7.5925
0 0.150	0.0130	0.8660	0.0500	0.0751	0.2966	0.1901	12.9649
0 0.150	0.0130	0.8660	0.0500	0.0972	0.3980	0.2507	17.4298
0 0.150	0.0130	0.8660	0.0500	0.1170	0.4882	0.3064	21.1591
0 0.150	0.0130	0.8660	0.0500	0.1354	0.5697	0.3596	24.7550
0 0.150	0.0150	0.8660	0.0500	0.1527	0.6446	0.4104	27.8291
00 0.150	0.0130	0.9659	0.0500	0.0470	0.1896	0.1201	7.6719
00 0.150	0.0130	0.9659	0.0500	0.0726	0.3168	0.1901	13.0995
00 0.150	0.0140	0.9659	0.0500	0.0938	0.4259	0.2507	17.6157
00 0.150	0.0130	0.9659	0.0500	0.1130	0.5213	0.3064	21.3553
00 0.150	0.0130	0.9659	0.0500	0.1307	0.6086	0.3596	25.0474
00 0.150	0.0150	0.9659	0.0500	0.1473	0.6899	0.4104	28.1356
00 0.150	0.0130	0.9962	0.0500	0.0465	0.1929	0.1201	7.6924
00 0.150	0.0130	0.9962	0.0500	0.0716	0.3229	0.1901	13.1579
00 0.150	0.0130	0.9962	0.0500	0.0930	0.4334	0.2507	17.7052
00 0.150	0.0150	0.9962	0.0500	0.1119	0.5316	0.3064	21.4457
00 0.150	0.0140	0.9962	0.0500	0.1293	0.6218	0.3596	25.1302
00 0.150	0.0150	0.9962	0.0500	0.1454	0.7032	0.4104	28.2171

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH TO NORMAL DEPTH. L/D.
2.00	0.150	0.0130	0.2566	0.0250	0.0710	0.0906	0.1508	7.3353
4.00	0.150	0.0130	0.2566	0.0250	0.1104	0.1487	0.2406	12.2103
6.00	0.150	0.0130	0.2566	0.0250	0.1439	0.1966	0.3196	16.0155
8.00	0.150	0.0130	0.2566	0.0250	0.1742	0.2385	0.3933	19.1665
10.00	0.150	0.0130	0.2566	0.0250	0.2025	0.2759	0.4631	21.5773
12.00	0.150	0.0130	0.2566	0.0250	0.2294	0.3100	0.5308	23.5905
2.00	0.150	0.0130	0.5000	0.0250	0.0577	0.1296	0.1508	7.9485
4.00	0.150	0.0130	0.5000	0.0250	0.0894	0.2149	0.2406	13.2653
6.00	0.150	0.0130	0.5000	0.0250	0.1160	0.2866	0.3196	17.4614
8.00	0.150	0.0130	0.5000	0.0250	0.1400	0.3497	0.3933	20.9520
10.00	0.150	0.0130	0.5000	0.0250	0.1622	0.4069	0.4631	23.8694
12.00	0.150	0.0130	0.5000	0.0250	0.1835	0.4582	0.5306	26.6046
2.00	0.150	0.0130	0.7070	0.0250	0.0518	0.1579	0.1508	8.2285
4.00	0.150	0.0130	0.7070	0.0250	0.0800	0.2636	0.2406	13.7521
6.00	0.150	0.0130	0.7070	0.0250	0.1038	0.3518	0.3196	18.1163
8.00	0.150	0.0130	0.7070	0.0250	0.1251	0.4303	0.3933	21.7645
10.00	0.150	0.0130	0.7070	0.0250	0.1447	0.5025	0.4631	24.8770
12.00	0.150	0.0130	0.7070	0.0250	0.1632	0.5688	0.5306	27.1353
2.00	0.150	0.0130	0.8660	0.0250	0.0486	0.1777	0.1508	8.3769
4.00	0.150	0.0130	0.8660	0.0250	0.0751	0.2965	0.2406	14.0062
6.00	0.150	0.0130	0.8660	0.0250	0.0972	0.3980	0.3196	18.4771
8.00	0.150	0.0130	0.8660	0.0250	0.1170	0.4882	0.3933	22.2289
10.00	0.150	0.0130	0.8660	0.0250	0.1354	0.5697	0.4631	25.2814
12.00	0.150	0.0130	0.8660	0.0250	0.1527	0.6446	0.5308	27.7374
2.00	0.150	0.0130	0.9659	0.0250	0.0470	0.1896	0.1508	8.4553
4.00	0.150	0.0130	0.9659	0.0250	0.0726	0.3168	0.2406	14.1395
6.00	0.150	0.0130	0.9659	0.0250	0.0936	0.4259	0.3196	18.6633
8.00	0.150	0.0130	0.9659	0.0250	0.1130	0.5218	0.3933	22.4859
10.00	0.150	0.0130	0.9659	0.0250	0.1307	0.6085	0.4631	25.6092
12.00	0.150	0.0130	0.9659	0.0250	0.1473	0.6899	0.5308	28.0402
2.00	0.150	0.0130	0.9962	0.0250	0.0465	0.1929	0.1508	8.4773
4.00	0.150	0.0130	0.9962	0.0250	0.0718	0.3229	0.2406	14.1773
6.00	0.150	0.0130	0.9962	0.0250	0.0930	0.4334	0.3196	18.7073
8.00	0.150	0.0130	0.9962	0.0250	0.1119	0.5316	0.3933	22.5373
10.00	0.150	0.0130	0.9962	0.0250	0.1293	0.6218	0.4631	25.7673
12.00	0.150	0.0130	0.9962	0.0250	0.1454	0.7032	0.5306	28.1306

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH NORMAL DEPTH. L/D.
2.00	0.150	0.0130	0.2588	0.0167	0.0710	0.0906	0.1725	6.5632
4.00	0.150	0.0130	0.2588	0.0167	0.1104	0.1487	0.2766	10.6332
6.00	0.150	0.0130	0.2588	0.0167	0.1439	0.1966	0.3694	13.3745
8.00	0.150	0.0130	0.2588	0.0167	0.1742	0.2385	0.4558	15.3170
10.00	0.150	0.0130	0.2588	0.0167	0.2025	0.2759	0.5366	15.9307
12.00	0.150	0.0130	0.2588	0.0167	0.2294	0.3100	0.6196	16.8905
2.00	0.150	0.0130	0.5000	0.0167	0.0577	0.1296	0.1725	7.1766
4.00	0.150	0.0130	0.5000	0.0167	0.0894	0.2149	0.2766	11.6926
6.00	0.150	0.0130	0.5000	0.0167	0.1160	0.2865	0.3694	14.8185
8.00	0.150	0.0130	0.5000	0.0167	0.1400	0.3497	0.4558	16.9536
10.00	0.150	0.0130	0.5000	0.0167	0.1622	0.4069	0.5366	17.4526
12.00	0.150	0.0130	0.5000	0.0167	0.1835	0.4582	0.6196	19.4474
2.00	0.150	0.0130	0.7070	0.0167	0.0518	0.1579	0.1725	7.4623
4.00	0.150	0.0130	0.7070	0.0167	0.0800	0.2636	0.2766	12.1915
6.00	0.150	0.0130	0.7070	0.0167	0.1036	0.3518	0.3694	15.4874
8.00	0.150	0.0130	0.7070	0.0167	0.1251	0.4303	0.4558	17.7015
10.00	0.150	0.0130	0.7070	0.0167	0.1447	0.5028	0.5386	17.7467
12.00	0.150	0.0130	0.7070	0.0167	0.1632	0.5688	0.6196	20.4405
2.00	0.150	0.0130	0.8660	0.0167	0.0486	0.1777	0.1725	7.6178
4.00	0.150	0.0130	0.8660	0.0167	0.0751	0.2966	0.2766	12.4540
6.00	0.150	0.0130	0.8660	0.0167	0.0972	0.3980	0.3694	15.8547
8.00	0.150	0.0130	0.8660	0.0167	0.1170	0.4882	0.4558	18.1573
10.00	0.150	0.0130	0.8660	0.0167	0.1354	0.5697	0.5366	17.4877
12.00	0.150	0.0130	0.8660	0.0167	0.1527	0.6445	0.6196	21.0213
2.00	0.150	0.0130	0.9659	0.0167	0.0470	0.1896	0.1725	7.6985
4.00	0.150	0.0130	0.9659	0.0167	0.0726	0.3168	0.2766	12.5924
6.00	0.150	0.0130	0.9659	0.0167	0.0936	0.4259	0.3694	16.0461
8.00	0.150	0.0130	0.9659	0.0167	0.1130	0.5218	0.4558	18.3967
10.00	0.150	0.0130	0.9659	0.0167	0.1307	0.6086	0.5366	17.0539
12.00	0.150	0.0130	0.9659	0.0167	0.1473	0.6899	0.6196	21.2955
2.00	0.150	0.0130	0.9962	0.0167	0.0465	0.1929	0.1725	7.7194
4.00	0.150	0.0130	0.9962	0.0167	0.0718	0.3229	0.2766	12.6321
6.00	0.150	0.0130	0.9962	0.0167	0.0930	0.4334	0.3694	16.0941
8.00	0.150	0.0130	0.9962	0.0167	0.1119	0.5315	0.4558	18.4553
10.00	0.150	0.0130	0.9962	0.0167	0.1293	0.6218	0.5366	16.8390
12.00	0.150	0.0130	0.9962	0.0167	0.1459	0.7032	0.6196	21.3742

D = 0.15
Q → 22 ℓ/s

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN ENTRY RATIO	FLOW DEPTH H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH T NORMAL DEPTH. L/D.
2.00	0.150	0.0090	0.2588	0.0500	0.0460		0.1973	0.0770	17.4232
14.00	0.150	0.0090	0.2588	0.0500	0.1593		0.8015	0.2791	76.2177
16.00	0.150	0.0090	0.2588	0.0500	0.1742		0.8755	0.3064	83.2004
18.00	0.150	0.0090	0.2588	0.0500	0.1886		0.9454	0.3333	90.0287
20.00	0.150	0.0090	0.2588	0.0500	0.2025		1.0123	0.3596	96.1427
22.00	0.150	0.0090	0.2588	0.0500	0.2162		1.0750	0.3850	103.7190
2.00	0.150	0.0090	0.5000	0.0500	0.0375		0.2919	0.0770	19.4863
14.00	0.150	0.0090	0.5000	0.0500	0.1283		1.2181	0.2791	85.0579
16.00	0.150	0.0090	0.5000	0.0500	0.1400		1.3357	0.3064	92.9312
18.00	0.150	0.0090	0.5000	0.0500	0.1515		1.4441	0.3333	101.1729
20.00	0.150	0.0090	0.5000	0.0500	0.1622		1.5545	0.3596	109.5392
22.00	0.150	0.0090	0.5000	0.0500	0.1730		1.6546	0.3850	115.8832
2.00	0.150	0.0090	0.7070	0.0500	0.0337		0.3592	0.0770	20.2637
14.00	0.150	0.0090	0.7070	0.0500	0.1147		1.5175	0.2791	88.4660
16.00	0.150	0.0090	0.7070	0.0500	0.1251		1.6651	0.3064	96.6575
18.00	0.150	0.0090	0.7070	0.0500	0.1351		1.8066	0.3333	105.3029
20.00	0.150	0.0090	0.7070	0.0500	0.1447		1.9463	0.3596	113.9653
22.00	0.150	0.0090	0.7070	0.0500	0.1542		2.0731	0.3850	120.6412
2.00	0.150	0.0090	0.8660	0.0500	0.0316		0.4069	0.0770	20.6619
14.00	0.150	0.0090	0.8660	0.0500	0.1074		1.7281	0.2791	90.2155
16.00	0.150	0.0090	0.8660	0.0500	0.1170		1.9002	0.3064	98.6440
18.00	0.150	0.0090	0.8660	0.0500	0.1263		2.0625	0.3333	107.4270
20.00	0.150	0.0090	0.8660	0.0500	0.1354		2.2177	0.3596	116.2048
22.00	0.150	0.0090	0.8660	0.0500	0.1442		2.3662	0.3850	123.0747
2.00	0.150	0.0090	0.9659	0.0500	0.0306		0.4344	0.0770	20.8545
14.00	0.150	0.0090	0.9659	0.0500	0.1037		1.8506	0.2791	91.0690
16.00	0.150	0.0090	0.9659	0.0500	0.1130		2.0363	0.3064	99.5933
18.00	0.150	0.0090	0.9659	0.0500	0.1220		2.2096	0.3333	108.4529
20.00	0.150	0.0090	0.9659	0.0500	0.1307		2.3757	0.3596	117.3021
22.00	0.150	0.0090	0.9659	0.0500	0.1390		2.5415	0.3850	124.2483
2.00	0.150	0.0090	0.9962	0.0500	0.0303		0.4426	0.0770	20.9075
14.00	0.150	0.0090	0.9962	0.0500	0.1026		1.8699	0.2791	91.3227
16.00	0.150	0.0090	0.9962	0.0500	0.1119		2.0759	0.3064	99.8508
18.00	0.150	0.0090	0.9962	0.0500	0.1206		2.2539	0.3333	108.7316
20.00	0.150	0.0090	0.9962	0.0500	0.1293		2.4292	0.3596	117.6457
22.00	0.150	0.0090	0.9962	0.0500	0.1376		2.5953	0.3850	124.6451

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH TO NORMAL DEPTH. L/D.
2.00	0.150	0.0090	0.2588	0.0250	0.0460	0.1973	0.0960	24.4377
14.00	0.150	0.0090	0.2588	0.0250	0.1593	0.6015	0.3567	102.7656
16.00	0.150	0.0090	0.2588	0.0250	0.1742	0.6755	0.3933	113.6783
18.00	0.150	0.0090	0.2588	0.0250	0.1886	0.9454	0.4205	122.0241
20.00	0.150	0.0090	0.2588	0.0250	0.2025	1.0123	0.4631	130.4772
22.00	0.150	0.0090	0.2588	0.0250	0.2162	1.0750	0.4976	139.3999
2.00	0.150	0.0090	0.5000	0.0250	0.0375	0.2919	0.0960	26.1320
14.00	0.150	0.0090	0.5000	0.0250	0.1263	1.2181	0.3567	110.2357
16.00	0.150	0.0090	0.5000	0.0250	0.1400	1.3357	0.3933	121.8557
18.00	0.150	0.0090	0.5000	0.0250	0.1515	1.4441	0.4205	130.9367
20.00	0.150	0.0090	0.5000	0.0250	0.1642	1.5545	0.4631	140.1504
22.00	0.150	0.0090	0.5000	0.0250	0.1730	1.6546	0.4976	149.7175
2.00	0.150	0.0090	0.7070	0.0250	0.0337	0.3592	0.0960	26.6259
14.00	0.150	0.0090	0.7070	0.0250	0.1147	1.5175	0.3567	113.3566
16.00	0.150	0.0090	0.7070	0.0250	0.1251	1.6651	0.3933	125.2612
18.00	0.150	0.0090	0.7070	0.0250	0.1351	1.8066	0.4205	134.7225
20.00	0.150	0.0090	0.7070	0.0250	0.1447	1.9463	0.4631	144.2312
22.00	0.150	0.0090	0.7070	0.0250	0.1542	2.0731	0.4976	154.0736
2.00	0.150	0.0090	0.8660	0.0250	0.0316	0.4069	0.0960	27.1916
14.00	0.150	0.0090	0.8660	0.0250	0.1074	1.7281	0.3567	115.0039
16.00	0.150	0.0090	0.8660	0.0250	0.1170	1.9002	0.3933	127.0942
18.00	0.150	0.0090	0.8660	0.0250	0.1263	2.0625	0.4205	136.7224
20.00	0.150	0.0090	0.8660	0.0250	0.1354	2.2177	0.4631	146.3550
22.00	0.150	0.0090	0.8660	0.0250	0.1442	2.3662	0.4976	156.3614
2.00	0.150	0.0090	0.9659	0.0250	0.0306	0.4344	0.0960	27.3737
14.00	0.150	0.0090	0.9659	0.0250	0.1037	1.8506	0.3567	115.8170
16.00	0.150	0.0090	0.9659	0.0250	0.1130	2.0363	0.3933	127.9905
18.00	0.150	0.0090	0.9659	0.0250	0.1220	2.2096	0.4205	137.6974
20.00	0.150	0.0090	0.9659	0.0250	0.1307	2.3757	0.4631	147.4040
22.00	0.150	0.0090	0.9659	0.0250	0.1390	2.5415	0.4976	157.5201
2.00	0.150	0.0090	0.9962	0.0250	0.0303	0.4426	0.0960	27.4262
14.00	0.150	0.0090	0.9962	0.0250	0.1026	1.8699	0.3567	116.0500
16.00	0.150	0.0090	0.9962	0.0250	0.1119	2.0759	0.3933	128.2342
18.00	0.150	0.0090	0.9962	0.0250	0.1208	2.2539	0.4205	137.9727
20.00	0.150	0.0090	0.9962	0.0250	0.1293	2.4292	0.4631	147.7554
22.00	0.150	0.0090	0.9962	0.0250	0.1376	2.5953	0.4976	157.8975

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH TO NORMAL DEPTH. L/D.
2.00	0.150	0.0090	0.2588	0.0167	0.0460	0.1973	0.1093	28.3700
14.00	0.150	0.0090	0.2588	0.0167	0.1593	0.6015	0.4133	117.6088
16.00	0.150	0.0090	0.2588	0.0167	0.1742	0.6755	0.4558	127.4747
18.00	0.150	0.0090	0.2588	0.0167	0.1886	0.9454	0.4976	136.9757
20.00	0.150	0.0090	0.2588	0.0167	0.2025	1.0123	0.5386	145.8459
22.00	0.150	0.0090	0.2588	0.0167	0.2162	1.0750	0.5796	155.5575
2.00	0.150	0.0090	0.5000	0.0167	0.0375	0.2919	0.1093	29.9749
14.00	0.150	0.0090	0.5000	0.0167	0.1263	1.2181	0.4133	124.7853
16.00	0.150	0.0090	0.5000	0.0167	0.1400	1.3357	0.4558	135.3753
18.00	0.150	0.0090	0.5000	0.0167	0.1515	1.4441	0.4976	145.5812
20.00	0.150	0.0090	0.5000	0.0167	0.1622	1.5545	0.5386	155.2090
22.00	0.150	0.0090	0.5000	0.0167	0.1730	1.6546	0.5796	165.5325
2.00	0.150	0.0090	0.7070	0.0167	0.0337	0.3592	0.1093	30.6498
14.00	0.150	0.0090	0.7070	0.0167	0.1147	1.5175	0.4133	127.8396
16.00	0.150	0.0090	0.7070	0.0167	0.1251	1.6651	0.4558	138.7596
18.00	0.150	0.0090	0.7070	0.0167	0.1351	1.8066	0.4976	149.3213
20.00	0.150	0.0090	0.7070	0.0167	0.1447	1.9463	0.5386	159.2400
22.00	0.150	0.0090	0.7070	0.0167	0.1542	2.0731	0.5796	169.8419
2.00	0.150	0.0090	0.8660	0.0167	0.0316	0.4069	0.1093	31.0089
14.00	0.150	0.0090	0.8660	0.0167	0.1074	1.7281	0.4133	129.4613
16.00	0.150	0.0090	0.8660	0.0167	0.1170	1.9002	0.4558	140.5625
18.00	0.150	0.0090	0.8660	0.0167	0.1263	2.0625	0.4976	151.3129
20.00	0.150	0.0090	0.8660	0.0167	0.1354	2.2177	0.5386	161.3570
22.00	0.150	0.0090	0.8660	0.0167	0.1442	2.3662	0.5796	170.8826
2.00	0.150	0.0090	0.9659	0.0167	0.0306	0.4344	0.1093	31.1956
14.00	0.150	0.0090	0.9659	0.0167	0.1037	1.8506	0.4133	130.2053
16.00	0.150	0.0090	0.9659	0.0167	0.1130	2.0363	0.4558	143.4414
18.00	0.150	0.0090	0.9659	0.0167	0.1220	2.2096	0.4976	154.5559
20.00	0.150	0.0090	0.9659	0.0167	0.1307	2.3757	0.5386	164.9653
22.00	0.150	0.0090	0.9659	0.0167	0.1390	2.5415	0.5796	167.5537
2.00	0.150	0.0090	0.9962	0.0167	0.0303	0.4426	0.1093	31.2345
14.00	0.150	0.0090	0.9962	0.0167	0.1026	1.8899	0.4133	129.4376
16.00	0.150	0.0090	0.9962	0.0167	0.1119	2.0759	0.4558	145.1781
18.00	0.150	0.0090	0.9962	0.0167	0.1208	2.2539	0.4976	155.3171
20.00	0.150	0.0090	0.9962	0.0167	0.1293	2.4292	0.5386	166.1353
22.00	0.150	0.0090	0.9962	0.0167	0.1376	2.5953	0.5796	166.6971

FLOW L/S.	DIA. F.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH TO NORMAL DEPTH. L/D.
2.00	0.150	0.0090	0.2588	0.0125	0.0460	0.1973	0.1201	30.8745
14.00	0.150	0.0090	0.2588	0.0125	0.1593	0.8615	0.4597	124.7729
16.00	0.150	0.0090	0.2588	0.0125	0.1742	0.8755	0.5083	136.1635
18.00	0.150	0.0090	0.2588	0.0125	0.1886	0.9454	0.5552	145.0079
20.00	0.150	0.0090	0.2588	0.0125	0.2025	1.0123	0.6021	154.6918
22.00	0.150	0.0090	0.2588	0.0125	0.2162	1.0750	0.6479	162.9501
2.00	0.150	0.0090	0.5000	0.0125	0.0375	0.2919	0.1201	32.4492
14.00	0.150	0.0090	0.5000	0.0125	0.1283	1.2181	0.4597	131.3374
16.00	0.150	0.0090	0.5000	0.0125	0.1400	1.3357	0.5083	143.4636
18.00	0.150	0.0090	0.5000	0.0125	0.1515	1.4441	0.5552	153.5332
20.00	0.150	0.0090	0.5000	0.0125	0.1622	1.5545	0.6021	163.9321
22.00	0.150	0.0090	0.5000	0.0125	0.1730	1.6546	0.6479	172.8004
2.00	0.150	0.0090	0.7070	0.0125	0.0337	0.3592	0.1201	33.1203
14.00	0.150	0.0090	0.7070	0.0125	0.1147	1.5175	0.4597	137.3503
16.00	0.150	0.0090	0.7070	0.0125	0.1251	1.6651	0.5083	146.3209
18.00	0.150	0.0090	0.7070	0.0125	0.1351	1.8066	0.5552	163.9750
20.00	0.150	0.0090	0.7070	0.0125	0.1447	1.9463	0.6021	164.1050
22.00	0.150	0.0090	0.7070	0.0125	0.1542	2.0731	0.6479	171.6454
2.00	0.150	0.0090	0.8660	0.0125	0.0316	0.4069	0.1201	33.4793
14.00	0.150	0.0090	0.8660	0.0125	0.1074	1.7281	0.4597	150.3715
16.00	0.150	0.0090	0.8660	0.0125	0.1170	1.9002	0.5083	145.1409
18.00	0.150	0.0090	0.8660	0.0125	0.1263	2.0625	0.5552	175.9994
20.00	0.150	0.0090	0.8660	0.0125	0.1354	2.2177	0.6021	160.9457
22.00	0.150	0.0090	0.8660	0.0125	0.1442	2.3662	0.6479	167.6558
2.00	0.150	0.0090	0.9659	0.0125	0.0306	0.4344	0.1201	33.6552
14.00	0.150	0.0090	0.9659	0.0125	0.1037	1.8505	0.4597	160.9153
16.00	0.150	0.0090	0.9659	0.0125	0.1130	2.0363	0.5083	144.5537
18.00	0.150	0.0090	0.9659	0.0125	0.1220	2.2096	0.5552	180.4150
20.00	0.150	0.0090	0.9659	0.0125	0.1307	2.3757	0.6021	159.3557
22.00	0.150	0.0090	0.9659	0.0125	0.1390	2.5415	0.6479	165.5957
2.00	0.150	0.0090	0.9962	0.0125	0.0303	0.4426	0.1201	33.7053
14.00	0.150	0.0090	0.9962	0.0125	0.1026	1.8699	0.4597	172.0024
16.00	0.150	0.0090	0.9962	0.0125	0.1119	2.0759	0.5083	144.5619
18.00	0.150	0.0090	0.9962	0.0125	0.1208	2.2539	0.5552	180.5113
20.00	0.150	0.0090	0.9962	0.0125	0.1293	2.4292	0.6021	159.5442
22.00	0.150	0.0090	0.9962	0.0125	0.1376	2.5953	0.6479	165.6057

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH TO NORMAL DEPTH. L/D.
2.00	0.150	0.0120	0.2588	0.0500	0.0550	0.1413	0.0925	11.8886
14.00	0.150	0.0120	0.2588	0.0500	0.1932	0.5574	0.3420	50.3711
16.00	0.150	0.0120	0.2588	0.0500	0.2115	0.6077	0.3767	55.3676
18.00	0.150	0.0120	0.2588	0.0500	0.2294	0.6544	0.4104	59.7773
20.00	0.150	0.0120	0.2588	0.0500	0.2468	0.6980	0.4436	64.2404
22.00	0.150	0.0120	0.2588	0.0500	0.2634	0.7417	0.4758	67.3275
2.00	0.150	0.0120	0.5000	0.0500	0.0446	0.2071	0.0925	13.2442
14.00	0.150	0.0120	0.5000	0.0500	0.1552	0.6430	0.3420	56.1251
16.00	0.150	0.0120	0.5000	0.0500	0.1696	0.9219	0.3767	61.6304
18.00	0.150	0.0120	0.5000	0.0500	0.1835	0.9966	0.4104	66.6305
20.00	0.150	0.0120	0.5000	0.0500	0.1969	1.0683	0.4436	71.6370
22.00	0.150	0.0120	0.5000	0.0500	0.2101	1.1356	0.4758	75.6652
2.00	0.150	0.0120	0.7070	0.0500	0.0403	0.2546	0.0925	13.7751
14.00	0.150	0.0120	0.7070	0.0500	0.1383	1.0523	0.3420	58.4000
16.00	0.150	0.0120	0.7070	0.0500	0.1510	1.1530	0.3767	64.2400
18.00	0.150	0.0120	0.7070	0.0500	0.1632	1.2491	0.4104	69.4318
20.00	0.150	0.0120	0.7070	0.0500	0.1752	1.3387	0.4436	74.0295
22.00	0.150	0.0120	0.7070	0.0500	0.1869	1.4232	0.4758	78.5602
2.00	0.150	0.0120	0.8660	0.0500	0.0378	0.2873	0.0925	14.0445
14.00	0.150	0.0120	0.8660	0.0500	0.1295	1.1958	0.3420	59.6364
16.00	0.150	0.0120	0.8660	0.0500	0.1412	1.3133	0.3767	65.5550
18.00	0.150	0.0120	0.8660	0.0500	0.1527	1.4217	0.4104	70.9424
20.00	0.150	0.0120	0.8660	0.0500	0.1637	1.5274	0.4436	76.1652
22.00	0.150	0.0120	0.8660	0.0500	0.1744	1.6276	0.4758	80.5359
2.00	0.150	0.0120	0.9659	0.0500	0.0365	0.3073	0.0925	14.1813
14.00	0.150	0.0120	0.9659	0.0500	0.1249	1.2841	0.3420	60.2471
16.00	0.150	0.0120	0.9659	0.0500	0.1364	1.4067	0.3767	66.1975
18.00	0.150	0.0120	0.9659	0.0500	0.1473	1.5247	0.4104	71.9543
20.00	0.150	0.0120	0.9659	0.0500	0.1576	1.6402	0.4436	76.9445
22.00	0.150	0.0120	0.9659	0.0500	0.1683	1.7449	0.4758	81.3473
2.00	0.150	0.0120	0.9962	0.0500	0.0362	0.3123	0.0925	14.2135
14.00	0.150	0.0120	0.9962	0.0500	0.1237	1.3090	0.3420	60.4063
16.00	0.150	0.0120	0.9962	0.0500	0.1349	1.4368	0.3767	66.3411
18.00	0.150	0.0120	0.9962	0.0500	0.1459	1.5545	0.4104	71.7475
20.00	0.150	0.0120	0.9962	0.0500	0.1564	1.6704	0.4436	77.1373
22.00	0.150	0.0120	0.9962	0.0500	0.1666	1.7801	0.4758	81.9745

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO M/D.	ENTRY ENERGY M.	NORMAL DEPTH M/D.	PIPE LENGTH TO NORMAL DEPTH. L/D.
2.00	0.150	0.0120	0.2588	0.0250	0.0550	0.1413	0.1155	15.7823
14.00	0.150	0.0120	0.2588	0.0250	0.1932	0.5574	0.4402	64.3342
16.00	0.150	0.0120	0.2588	0.0250	0.2115	0.6077	0.4861	69.2627
18.00	0.150	0.0120	0.2588	0.0250	0.2294	0.6544	0.5308	74.5447
20.00	0.150	0.0120	0.2588	0.0250	0.2468	0.6980	0.5757	80.1173
22.00	0.150	0.0120	0.2588	0.0250	0.2634	0.7417	0.6187	83.6944
2.00	0.150	0.0120	0.5000	0.0250	0.0446	0.2071	0.1155	16.9157
14.00	0.150	0.0120	0.5000	0.0250	0.1552	0.6430	0.4402	69.2911
16.00	0.150	0.0120	0.5000	0.0250	0.1696	0.7219	0.4861	75.3195
18.00	0.150	0.0120	0.5000	0.0250	0.1835	0.7965	0.5308	80.5053
20.00	0.150	0.0120	0.5000	0.0250	0.1969	1.0683	0.5757	86.5355
22.00	0.150	0.0120	0.5000	0.0250	0.2101	1.1356	0.6187	90.5527
2.00	0.150	0.0120	0.7070	0.0250	0.0403	0.2546	0.1155	17.4029
14.00	0.150	0.0120	0.7070	0.0250	0.1383	1.0523	0.4402	71.4573
16.00	0.150	0.0120	0.7070	0.0250	0.1510	1.1530	0.4861	77.7143
18.00	0.150	0.0120	0.7070	0.0250	0.1632	1.2491	0.5308	83.1349
20.00	0.150	0.0120	0.7070	0.0250	0.1752	1.3387	0.5757	89.3457
22.00	0.150	0.0120	0.7070	0.0250	0.1869	1.4232	0.6187	93.5591
2.00	0.150	0.0120	0.8660	0.0250	0.0378	0.2673	0.1155	17.6544
14.00	0.150	0.0120	0.8660	0.0250	0.1295	1.1956	0.4402	72.5755
16.00	0.150	0.0120	0.8660	0.0250	0.1412	1.3133	0.4861	78.9665
18.00	0.150	0.0120	0.8660	0.0250	0.1527	1.4217	0.5308	84.4930
20.00	0.150	0.0120	0.8660	0.0250	0.1637	1.5274	0.5757	90.5194
22.00	0.150	0.0120	0.8660	0.0250	0.1744	1.6276	0.6187	95.1755
2.00	0.150	0.0120	0.9659	0.0250	0.0365	0.3073	0.1155	17.7343
14.00	0.150	0.0120	0.9659	0.0250	0.1249	1.2541	0.4402	73.1675
16.00	0.150	0.0120	0.9659	0.0250	0.1364	1.4067	0.4861	79.5934
18.00	0.150	0.0120	0.9659	0.0250	0.1473	1.5247	0.5308	85.1553
20.00	0.150	0.0120	0.9659	0.0250	0.1578	1.6402	0.5757	91.5732
22.00	0.150	0.0120	0.9659	0.0250	0.1683	1.7449	0.6187	95.9681
2.00	0.150	0.0120	0.9962	0.0250	0.0352	0.3123	0.1155	17.8153
14.00	0.150	0.0120	0.9962	0.0250	0.1237	1.3090	0.4402	73.3225
16.00	0.150	0.0120	0.9962	0.0250	0.1349	1.4360	0.4861	79.7833
18.00	0.150	0.0120	0.9962	0.0250	0.1459	1.5545	0.5308	85.3753
20.00	0.150	0.0120	0.9962	0.0250	0.1564	1.6704	0.5757	91.7813
22.00	0.150	0.0120	0.9962	0.0250	0.1666	1.7801	0.6187	96.1981

	DIA. FT.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO H/D.	ENTRY ENERGY H.	NORMAL DEPTH H/D.	PIPE LENGTH TO NORMAL DEPTH. L/D.
00	0.150	0.0120	0.2588	0.0125	0.0550	0.1413	0.1449	10.0751
00	0.150	0.0120	0.2588	0.0125	0.1332	0.5074	0.5708	60.4773
00	0.150	0.0120	0.2588	0.0125	0.2145	0.8077	0.8323	70.7755
00	0.150	0.0120	0.2588	0.0125	0.2294	0.8644	0.8429	74.5020
00	0.150	0.0120	0.2588	0.0125	0.2451	0.9209	0.9534	77.4959
00	0.150	0.0120	0.2588	0.0125	0.2634	0.7417	0.8120	80.4515
00	0.150	0.0120	0.5000	0.0125	0.0448	0.2071	0.1449	19.1021
00	0.150	0.0120	0.5000	0.0125	0.1552	0.6430	0.5708	71.3552
00	0.150	0.0120	0.5000	0.0125	0.1896	0.9219	0.8323	70.1172
00	0.150	0.0120	0.5000	0.0125	0.1935	0.9965	0.8429	80.3922
00	0.150	0.0120	0.5000	0.0125	0.1969	1.0063	0.7534	84.3000
00	0.150	0.0120	0.5000	0.0125	0.2101	1.1356	0.8120	87.2993
00	0.150	0.0120	0.7070	0.0125	0.0403	0.2546	0.1449	19.0425
00	0.150	0.0120	0.7070	0.0125	0.1353	1.0523	0.5708	77.3223
00	0.150	0.0120	0.7070	0.0125	0.1510	1.1530	0.6323	80.0341
00	0.150	0.0120	0.7070	0.0125	0.1532	1.2491	0.6929	84.3724
00	0.150	0.0120	0.7070	0.0125	0.1752	1.3357	0.7534	80.3004
00	0.150	0.0120	0.7070	0.0125	0.1909	1.4232	0.8120	90.7052
00	0.150	0.0120	0.8660	0.0125	0.0378	0.2673	0.1449	19.0950
00	0.150	0.0120	0.8660	0.0125	0.1295	1.1959	0.5708	84.3052
00	0.150	0.0120	0.8660	0.0125	0.1412	1.3133	0.6323	84.5473
00	0.150	0.0120	0.8660	0.0125	0.1527	1.4217	0.6929	80.3017
00	0.150	0.0120	0.8660	0.0125	0.1637	1.5274	0.7534	87.1553
00	0.150	0.0120	0.8660	0.0125	0.1744	1.6276	0.8120	102.1242
00	0.150	0.0120	0.9659	0.0125	0.0365	0.3073	0.1449	20.0315
00	0.150	0.0120	0.9659	0.0125	0.1249	1.2541	0.5708	87.5340
00	0.150	0.0120	0.9659	0.0125	0.1364	1.4067	0.6323	80.4145
00	0.150	0.0120	0.9659	0.0125	0.1473	1.5247	0.6929	84.0377
00	0.150	0.0120	0.9659	0.0125	0.1578	1.6402	0.7534	87.6393
00	0.150	0.0120	0.9659	0.0125	0.1683	1.7449	0.8120	100.1039
00	0.150	0.0120	0.9962	0.0125	0.0352	0.3123	0.1449	20.1191
00	0.150	0.0120	0.9962	0.0125	0.1237	1.3090	0.5708	80.4711
00	0.150	0.0120	0.9962	0.0125	0.1349	1.4363	0.6323	80.0000
00	0.150	0.0120	0.9962	0.0125	0.1454	1.5545	0.6929	90.0000
00	0.150	0.0120	0.9962	0.0125	0.1554	1.6704	0.7534	87.7400
00	0.150	0.0120	0.9962	0.0125	0.1656	1.7801	0.8120	100.7000

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH TO NORMAL DEPTH. L/D.
2.00	0.150	0.0120	0.2566	0.0167	0.0550	0.1413	0.1320	17.7315
14.00	0.150	0.0120	0.2566	0.0167	0.1932	0.3574	0.5112	67.7064
16.00	0.150	0.0120	0.2566	0.0167	0.2115	0.6077	0.5659	73.2215
18.00	0.150	0.0120	0.2566	0.0167	0.2294	0.6544	0.6196	78.1463
20.00	0.150	0.0120	0.2566	0.0167	0.2456	0.6960	0.6724	82.3665
22.00	0.150	0.0120	0.2566	0.0167	0.2634	0.7417	0.7241	85.9427
2.00	0.150	0.0120	0.5000	0.0167	0.0448	0.2071	0.1320	18.8156
14.00	0.150	0.0120	0.5000	0.0167	0.1552	0.8430	0.5112	72.5674
16.00	0.150	0.0120	0.5000	0.0167	0.1696	0.9219	0.5659	78.5709
18.00	0.150	0.0120	0.5000	0.0167	0.1835	0.9965	0.6196	83.9702
20.00	0.150	0.0120	0.5000	0.0167	0.1969	1.0683	0.6724	88.7131
22.00	0.150	0.0120	0.5000	0.0167	0.2101	1.1356	0.7241	92.7304
2.00	0.150	0.0120	0.7070	0.0167	0.0403	0.2546	0.1320	19.2865
14.00	0.150	0.0120	0.7070	0.0167	0.1383	1.0523	0.5112	74.7393
16.00	0.150	0.0120	0.7070	0.0167	0.1510	1.1530	0.5659	80.4705
18.00	0.150	0.0120	0.7070	0.0167	0.1632	1.2491	0.6196	86.0619
20.00	0.150	0.0120	0.7070	0.0167	0.1752	1.3387	0.6724	91.5336
22.00	0.150	0.0120	0.7070	0.0167	0.1869	1.4232	0.7241	95.7534
2.00	0.150	0.0120	0.8660	0.0167	0.0378	0.2873	0.1320	19.5503
14.00	0.150	0.0120	0.8660	0.0167	0.1295	1.1958	0.5112	75.6725
16.00	0.150	0.0120	0.8660	0.0167	0.1412	1.3133	0.5659	84.2355
18.00	0.150	0.0120	0.8660	0.0167	0.1527	1.4217	0.6196	80.9559
20.00	0.150	0.0120	0.8660	0.0167	0.1637	1.5274	0.6724	91.6770
22.00	0.150	0.0120	0.8660	0.0167	0.1744	1.6276	0.7241	29.1017
2.00	0.150	0.0120	0.9659	0.0167	0.0365	0.3073	0.1320	19.6548
14.00	0.150	0.0120	0.9659	0.0167	0.1249	1.2841	0.5112	77.2913
16.00	0.150	0.0120	0.9659	0.0167	0.1364	1.4067	0.5659	91.5640
18.00	0.150	0.0120	0.9659	0.0167	0.1473	1.5247	0.6196	86.1949
20.00	0.150	0.0120	0.9659	0.0167	0.1578	1.6402	0.6724	91.2735
22.00	0.150	0.0120	0.9659	0.0167	0.1683	1.7449	0.7241	90.6734
2.00	0.150	0.0120	0.9962	0.0167	0.0362	0.3123	0.1320	19.6953
14.00	0.150	0.0120	0.9962	0.0167	0.1237	1.3090	0.5112	77.7550
16.00	0.150	0.0120	0.9962	0.0167	0.1349	1.4366	0.5659	93.9065
18.00	0.150	0.0120	0.9962	0.0167	0.1454	1.5545	0.6196	88.9773
20.00	0.150	0.0120	0.9962	0.0167	0.1554	1.6704	0.6724	91.1973
22.00	0.150	0.0120	0.9962	0.0167	0.1666	1.7801	0.7241	84.5904

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH NORMAL DEPTH L/D.
2.00	0.150	0.0150	0.2588	0.0500	0.0633	0.1100	0.1068	8.6502
14.00	0.150	0.0150	0.2588	0.0500	0.2250	0.4236	0.4021	35.6544
16.00	0.150	0.0150	0.2588	0.0500	0.2468	0.4601	0.4436	38.8557
18.00	0.150	0.0150	0.2588	0.0500	0.2678	0.4949	0.4841	41.8134
20.00	0.150	0.0150	0.2588	0.0500	0.2883	0.5277	0.5239	44.5258
22.00	0.150	0.0150	0.2588	0.0500	0.3083	0.5588	0.5630	46.9423
2.00	0.150	0.0150	0.5000	0.0500	0.0515	0.1597	0.1068	9.6042
14.00	0.150	0.0150	0.5000	0.0500	0.1801	0.6357	0.4021	39.6793
16.00	0.150	0.0150	0.5000	0.0500	0.1969	0.6943	0.4436	43.3195
18.00	0.150	0.0150	0.5000	0.0500	0.2133	0.7492	0.4841	46.6062
20.00	0.150	0.0150	0.5000	0.0500	0.2291	0.8015	0.5239	49.6710
22.00	0.150	0.0150	0.5000	0.0500	0.2449	0.8494	0.5630	52.3979
2.00	0.150	0.0150	0.7070	0.0500	0.0462	0.1953	0.1068	9.9902
14.00	0.150	0.0150	0.7070	0.0500	0.1603	0.7922	0.4021	41.3743
16.00	0.150	0.0150	0.7070	0.0500	0.1752	0.8662	0.4436	45.1762
18.00	0.150	0.0150	0.7070	0.0500	0.1896	0.9361	0.4841	48.6256
20.00	0.150	0.0150	0.7070	0.0500	0.2037	1.0008	0.5239	51.8248
22.00	0.150	0.0150	0.7070	0.0500	0.2174	1.0636	0.5630	54.7164
2.00	0.150	0.0150	0.8660	0.0500	0.0434	0.2201	0.1068	10.1863
14.00	0.150	0.0150	0.8660	0.0500	0.1496	0.9021	0.4021	42.2582
16.00	0.150	0.0150	0.8660	0.0500	0.1637	0.9864	0.4436	46.1428
18.00	0.150	0.0150	0.8660	0.0500	0.1771	1.0663	0.4841	49.6742
20.00	0.150	0.0150	0.8660	0.0500	0.1901	1.1433	0.5239	52.9747
22.00	0.150	0.0150	0.8660	0.0500	0.2028	1.2157	0.5630	55.9491
2.00	0.150	0.0150	0.9659	0.0500	0.0420	0.2350	0.1068	10.2694
14.00	0.150	0.0150	0.9659	0.0500	0.1447	0.9647	0.4021	42.6860
16.00	0.150	0.0150	0.9659	0.0500	0.1578	1.0552	0.4436	46.6325
18.00	0.150	0.0150	0.9659	0.0500	0.1708	1.1441	0.4841	50.2056
20.00	0.150	0.0150	0.9659	0.0500	0.1832	1.2270	0.5239	53.5470
22.00	0.150	0.0150	0.9659	0.0500	0.1954	1.3051	0.5630	56.5624
2.00	0.150	0.0150	0.9962	0.0500	0.0415	0.2397	0.1068	10.3180
14.00	0.150	0.0150	0.9962	0.0500	0.1432	0.9839	0.4021	42.8078
16.00	0.150	0.0150	0.9962	0.0500	0.1564	1.0775	0.4436	46.7545
18.00	0.150	0.0150	0.9962	0.0500	0.1691	1.1666	0.4841	50.3454
20.00	0.150	0.0150	0.9962	0.0500	0.1813	1.2527	0.5239	53.7103
22.00	0.150	0.0150	0.9962	0.0500	0.1935	1.3307	0.5630	56.7257

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY RATIO	DEPTH M/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH TI NORMAL DEPTH. L/D.
2.00	0.150	0.0150	0.2566	0.0250	0.0633		0.1100	0.1337	10.7377
14.00	0.150	0.0150	0.2588	0.0250	0.2250		0.4236	0.5200	41.1627
16.00	0.150	0.0150	0.2566	0.0250	0.2468		0.4601	0.5757	44.3400
18.00	0.150	0.0150	0.2566	0.0250	0.2676		0.4949	0.6294	46.5270
20.00	0.150	0.0150	0.2566	0.0250	0.2863		0.5277	0.6831	49.0690
22.00	0.150	0.0150	0.2566	0.0250	0.3043		0.5588	0.7368	51.5523
2.00	0.150	0.0150	0.5000	0.0250	0.0515		0.1597	0.1337	11.5501
14.00	0.150	0.0150	0.5000	0.0250	0.1801		0.6357	0.5200	44.7311
16.00	0.150	0.0150	0.5000	0.0250	0.1969		0.6943	0.5757	48.2550
18.00	0.150	0.0150	0.5000	0.0250	0.2133		0.7492	0.6294	50.4270
20.00	0.150	0.0150	0.5000	0.0250	0.2291		0.8015	0.6831	53.7000
22.00	0.150	0.0150	0.5000	0.0250	0.2449		0.8494	0.7368	56.4671
2.00	0.150	0.0150	0.7070	0.0250	0.0462		0.1953	0.1337	11.9140
14.00	0.150	0.0150	0.7070	0.0250	0.1603		0.7922	0.5200	46.3446
16.00	0.150	0.0150	0.7070	0.0250	0.1752		0.8662	0.5757	50.0529
18.00	0.150	0.0150	0.7070	0.0250	0.1896		0.9361	0.6294	52.8877
20.00	0.150	0.0150	0.7070	0.0250	0.2037		1.0008	0.6831	55.7755
22.00	0.150	0.0150	0.7070	0.0250	0.2174		1.0635	0.7368	58.7018
2.00	0.150	0.0150	0.8660	0.0250	0.0434		0.2201	0.1337	12.1030
14.00	0.150	0.0150	0.8660	0.0250	0.1498		0.9021	0.5200	47.2074
16.00	0.150	0.0150	0.8660	0.0250	0.1637		0.9864	0.5757	51.0013
18.00	0.150	0.0150	0.8660	0.0250	0.1771		1.0663	0.6294	53.9005
20.00	0.150	0.0150	0.8660	0.0250	0.1901		1.1433	0.6831	56.9107
22.00	0.150	0.0150	0.8660	0.0250	0.2028		1.2157	0.7368	59.9129
2.00	0.150	0.0150	0.9659	0.0250	0.0420		0.2350	0.1337	12.2000
14.00	0.150	0.0150	0.9659	0.0250	0.1447		0.9647	0.5200	47.6294
16.00	0.150	0.0150	0.9659	0.0250	0.1578		1.0582	0.5757	51.4557
18.00	0.150	0.0150	0.9659	0.0250	0.1708		1.1441	0.6294	54.4295
20.00	0.150	0.0150	0.9659	0.0250	0.1832		1.2270	0.6831	57.4312
22.00	0.150	0.0150	0.9659	0.0250	0.1954		1.3051	0.7368	60.5227
2.00	0.150	0.0150	0.9962	0.0250	0.0415		0.2397	0.1337	12.2270
14.00	0.150	0.0150	0.9962	0.0250	0.1432		0.9939	0.5200	47.7449
16.00	0.150	0.0150	0.9962	0.0250	0.1564		1.0775	0.5757	51.6069
18.00	0.150	0.0150	0.9962	0.0250	0.1691		1.1666	0.6294	54.5721
20.00	0.150	0.0150	0.9962	0.0250	0.1813		1.2527	0.6831	57.6445
22.00	0.150	0.0150	0.9962	0.0250	0.1935		1.3307	0.7368	60.6667

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH T NORMAL DEPTH. L/D.
2.00	0.150	0.0150	0.2588	0.0167	0.0633	0.1100	0.1527	11.0444
14.00	0.150	0.0150	0.2588	0.0167	0.2250	0.4236	0.6060	30.0321
16.00	0.150	0.0150	0.2588	0.0167	0.2468	0.4601	0.6724	40.1312
18.00	0.150	0.0150	0.2588	0.0167	0.2676	0.4949	0.7368	41.6353
20.00	0.150	0.0150	0.2588	0.0167	0.2863	0.5277	0.8013	42.8994
22.00	0.150	0.0150	0.2588	0.0167	0.3083	0.5588	0.8647	43.7873
2.00	0.150	0.0150	0.5000	0.0167	0.0515	0.1597	0.1527	11.8447
14.00	0.150	0.0150	0.5000	0.0167	0.1801	0.6357	0.6060	41.6011
16.00	0.150	0.0150	0.5000	0.0167	0.1969	0.6943	0.6724	44.0872
18.00	0.150	0.0150	0.5000	0.0167	0.2133	0.7492	0.7368	45.9458
20.00	0.150	0.0150	0.5000	0.0167	0.2291	0.8015	0.8013	47.5525
22.00	0.150	0.0150	0.5000	0.0167	0.2449	0.8494	0.8647	48.7473
2.00	0.150	0.0150	0.7070	0.0167	0.0462	0.1953	0.1527	12.2030
14.00	0.150	0.0150	0.7070	0.0167	0.1603	0.7922	0.6060	43.2469
16.00	0.150	0.0150	0.7070	0.0167	0.1752	0.8662	0.6724	45.9004
18.00	0.150	0.0150	0.7070	0.0167	0.1896	0.9361	0.7368	47.9259
20.00	0.150	0.0150	0.7070	0.0167	0.2037	1.0006	0.8013	49.6751
22.00	0.150	0.0150	0.7070	0.0167	0.2174	1.0636	0.8647	51.0290
2.00	0.150	0.0150	0.8660	0.0167	0.0434	0.2201	0.1527	12.3939
14.00	0.150	0.0150	0.8660	0.0167	0.1498	0.9021	0.6060	44.4383
16.00	0.150	0.0150	0.8660	0.0167	0.1637	0.9864	0.6724	46.6291
18.00	0.150	0.0150	0.8660	0.0167	0.1771	1.0663	0.7368	49.3657
20.00	0.150	0.0150	0.8660	0.0167	0.1901	1.1433	0.8013	50.2755
22.00	0.150	0.0150	0.8660	0.0167	0.2028	1.2157	0.8647	52.2072
2.00	0.150	0.0150	0.9659	0.0167	0.0420	0.2350	0.1527	12.4929
14.00	0.150	0.0150	0.9659	0.0167	0.1447	0.9647	0.6060	45.2876
16.00	0.150	0.0150	0.9659	0.0167	0.1578	1.0582	0.6724	46.9167
18.00	0.150	0.0150	0.9659	0.0167	0.1708	1.1441	0.7368	50.1553
20.00	0.150	0.0150	0.9659	0.0167	0.1832	1.2270	0.8013	50.5714
22.00	0.150	0.0150	0.9659	0.0167	0.1954	1.3051	0.8647	52.9023
2.00	0.150	0.0150	0.9962	0.0167	0.0415	0.2397	0.1527	12.5213
14.00	0.150	0.0150	0.9962	0.0167	0.1432	0.9839	0.6060	45.5317
16.00	0.150	0.0150	0.9962	0.0167	0.1564	1.0775	0.6724	46.9659
18.00	0.150	0.0150	0.9962	0.0167	0.1691	1.1666	0.7368	50.3703
20.00	0.150	0.0150	0.9962	0.0167	0.1813	1.2527	0.8013	50.8567
22.00	0.150	0.0150	0.9962	0.0167	0.1935	1.3307	0.8647	52.9617

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO M/D.	ENTRY ENERGY M.	NORMAL DEPTH M/D.	PIPE LENGTH TO NORMAL DEPTH. L/D.
2.00	0.150	0.0150	0.2588	0.0125	0.0633	0.1100	0.1681	10.3002
14.00	0.150	0.0150	0.2588	0.0125	0.2250	0.4236	0.6702	29.3991
16.00	0.150	0.0150	0.2588	0.0125	0.2408	0.4601	0.7534	29.9153
18.00	0.150	0.0150	0.2588	0.0125	0.2678	0.4949	0.8207	24.7727
20.00	0.150	0.0150	0.2588	0.0125	0.2883	0.5277	0.8999	29.0130
22.00	0.150	0.0150	0.2588	0.0125	0.3063	0.5589	0.9722	29.0737
2.00	0.150	0.0150	0.5000	0.0125	0.0515	0.1597	0.1681	11.1153
14.00	0.150	0.0150	0.5000	0.0125	0.1801	0.6357	0.6782	32.2441
16.00	0.150	0.0150	0.5000	0.0125	0.1969	0.6943	0.7534	34.5346
18.00	0.150	0.0150	0.5000	0.0125	0.2133	0.7492	0.8207	37.4175
20.00	0.150	0.0150	0.5000	0.0125	0.2291	0.8015	0.8999	31.4574
22.00	0.150	0.0150	0.5000	0.0125	0.2449	0.8494	0.9722	34.0067
2.00	0.150	0.0150	0.7070	0.0125	0.0462	0.1953	0.1681	11.4820
14.00	0.150	0.0150	0.7070	0.0125	0.1603	0.7922	0.6782	33.3597
16.00	0.150	0.0150	0.7070	0.0125	0.1752	0.8662	0.7534	36.2501
18.00	0.150	0.0150	0.7070	0.0125	0.1896	0.9361	0.8207	37.3394
20.00	0.150	0.0150	0.7070	0.0125	0.2037	1.0003	0.8999	31.3203
22.00	0.150	0.0150	0.7070	0.0125	0.2174	1.0636	0.9722	35.6115
2.00	0.150	0.0150	0.8660	0.0125	0.0434	0.2201	0.1681	11.6752
14.00	0.150	0.0150	0.8660	0.0125	0.1496	0.9021	0.6782	33.8373
16.00	0.150	0.0150	0.8660	0.0125	0.1637	0.9864	0.7534	37.1320
18.00	0.150	0.0150	0.8660	0.0125	0.1771	1.0663	0.8207	37.7045
20.00	0.150	0.0150	0.8660	0.0125	0.1901	1.1433	0.8999	29.7345
22.00	0.150	0.0150	0.8660	0.0125	0.2028	1.2157	0.9722	36.4330
2.00	0.150	0.0150	0.9659	0.0125	0.0420	0.2350	0.1681	11.8341
14.00	0.150	0.0150	0.9659	0.0125	0.1447	0.9047	0.6782	34.0201
16.00	0.150	0.0150	0.9659	0.0125	0.1578	1.0582	0.7534	37.5000
18.00	0.150	0.0150	0.9659	0.0125	0.1708	1.1441	0.8207	38.0357
20.00	0.150	0.0150	0.9659	0.0125	0.1832	1.2270	0.8999	27.0000
22.00	0.150	0.0150	0.9659	0.0125	0.1954	1.3051	0.9722	36.4284
2.00	0.150	0.0150	0.9962	0.0125	0.0415	0.2397	0.1681	11.9053
14.00	0.150	0.0150	0.9962	0.0125	0.1432	0.9039	0.6782	34.0945
16.00	0.150	0.0150	0.9962	0.0125	0.1564	1.0775	0.7534	37.6707
18.00	0.150	0.0150	0.9962	0.0125	0.1691	1.1566	0.8207	38.1119
20.00	0.150	0.0150	0.9962	0.0125	0.1813	1.2327	0.8999	26.7119
22.00	0.150	0.0150	0.9962	0.0125	0.1935	1.3307	0.9722	36.9284

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH NORMAL DEPTH L/D.
2.00	0.150	0.0130	0.2566	0.0500	0.0710	0.0906	0.1201	6.4465
14.00	0.150	0.0130	0.2566	0.0500	0.2551	0.3414	0.4597	25.7216
16.00	0.150	0.0130	0.2566	0.0500	0.2800	0.3707	0.5063	28.0557
18.00	0.150	0.0130	0.2566	0.0500	0.3040	0.3957	0.5552	29.7735
20.00	0.150	0.0130	0.2566	0.0500	0.3279	0.4238	0.6021	31.7143
22.00	0.150	0.0130	0.2566	0.0500	0.3508	0.4485	0.6479	33.3409
2.00	0.150	0.0130	0.5000	0.0500	0.0577	0.1296	0.1201	7.1413
14.00	0.150	0.0130	0.5000	0.0500	0.2035	0.5071	0.4597	26.6615
16.00	0.150	0.0130	0.5000	0.0500	0.2228	0.5527	0.5083	31.2745
18.00	0.150	0.0130	0.5000	0.0500	0.2416	0.5952	0.5552	33.2354
20.00	0.150	0.0130	0.5000	0.0500	0.2600	0.6347	0.6021	35.4241
22.00	0.150	0.0130	0.5000	0.0500	0.2781	0.6719	0.6479	37.2603
2.00	0.150	0.0130	0.7070	0.0500	0.0518	0.1579	0.1201	7.4375
14.00	0.150	0.0130	0.7070	0.0500	0.1810	0.6293	0.4597	29.9452
16.00	0.150	0.0130	0.7070	0.0500	0.1981	0.6863	0.5083	32.6757
18.00	0.150	0.0130	0.7070	0.0500	0.2145	0.7413	0.5552	34.7721
20.00	0.150	0.0130	0.7070	0.0500	0.2306	0.7920	0.6021	37.0753
22.00	0.150	0.0130	0.7070	0.0500	0.2463	0.8400	0.6479	39.0296
2.00	0.150	0.0130	0.8660	0.0500	0.0486	0.1777	0.1201	7.5925
14.00	0.150	0.0130	0.8660	0.0500	0.1691	0.7157	0.4597	30.6337
16.00	0.150	0.0130	0.8660	0.0500	0.1849	0.7813	0.5083	33.4283
18.00	0.150	0.0130	0.8660	0.0500	0.2003	0.8430	0.5552	35.5807
20.00	0.150	0.0130	0.8660	0.0500	0.2152	0.9018	0.6021	37.9493
22.00	0.150	0.0130	0.8660	0.0500	0.2296	0.9587	0.6479	39.9742
2.00	0.150	0.0130	0.9659	0.0500	0.0470	0.1896	0.1201	7.6719
14.00	0.150	0.0130	0.9659	0.0500	0.1632	0.7653	0.4597	30.9695
16.00	0.150	0.0130	0.9659	0.0500	0.1783	0.8371	0.5083	33.8050
18.00	0.150	0.0130	0.9659	0.0500	0.1930	0.9047	0.5552	36.0002
20.00	0.150	0.0130	0.9659	0.0500	0.2074	0.9674	0.6021	38.3945
22.00	0.150	0.0130	0.9659	0.0500	0.2213	1.0281	0.6479	40.4456
2.00	0.150	0.0130	0.9962	0.0500	0.0465	0.1929	0.1201	7.6924
14.00	0.150	0.0130	0.9962	0.0500	0.1615	0.7808	0.4597	31.0674
16.00	0.150	0.0130	0.9962	0.0500	0.1764	0.8548	0.5083	33.9107
18.00	0.150	0.0130	0.9962	0.0500	0.1910	0.9224	0.5552	36.1120
20.00	0.150	0.0130	0.9962	0.0500	0.2052	0.9872	0.6021	38.5197
22.00	0.150	0.0130	0.9962	0.0500	0.2189	1.0500	0.6479	40.5545

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH TO NORMAL DEPTH. L/D.
2.00	0.150	0.0130	0.2586	0.0250	0.0710	0.0906	0.1508	7.3353
14.00	0.150	0.0130	0.2586	0.0250	0.2551	0.3414	0.5972	25.3315
16.00	0.150	0.0130	0.2586	0.0250	0.2800	0.3707	0.6616	26.6107
18.00	0.150	0.0130	0.2586	0.0250	0.3040	0.3987	0.7201	27.8004
20.00	0.150	0.0130	0.2586	0.0250	0.3279	0.4238	0.7886	28.5459
22.00	0.150	0.0130	0.2586	0.0250	0.3508	0.4485	0.8511	29.1840
2.00	0.150	0.0130	0.5000	0.0250	0.0577	0.1296	0.1508	7.9485
14.00	0.150	0.0130	0.5000	0.0250	0.2035	0.5071	0.5972	26.0321
16.00	0.150	0.0130	0.5000	0.0250	0.2228	0.5527	0.6616	29.5923
18.00	0.150	0.0130	0.5000	0.0250	0.2416	0.5952	0.7201	31.0134
20.00	0.150	0.0130	0.5000	0.0250	0.2600	0.6347	0.7886	32.0106
22.00	0.150	0.0130	0.5000	0.0250	0.2781	0.6719	0.8511	32.5590
2.00	0.150	0.0130	0.7070	0.0250	0.0518	0.1579	0.1508	8.2235
14.00	0.150	0.0130	0.7070	0.0250	0.1810	0.6293	0.5972	29.2900
16.00	0.150	0.0130	0.7070	0.0250	0.1981	0.6863	0.6616	30.9759
18.00	0.150	0.0130	0.7070	0.0250	0.2145	0.7413	0.7201	32.5272
20.00	0.150	0.0130	0.7070	0.0250	0.2306	0.7920	0.7886	33.6457
22.00	0.150	0.0130	0.7070	0.0250	0.2463	0.8400	0.8511	34.6173
2.00	0.150	0.0130	0.8660	0.0250	0.0486	0.1777	0.1508	8.3759
14.00	0.150	0.0130	0.8660	0.0250	0.1691	0.7157	0.5972	29.9754
16.00	0.150	0.0130	0.8660	0.0250	0.1849	0.7813	0.6616	31.7315
18.00	0.150	0.0130	0.8660	0.0250	0.2003	0.8430	0.7201	33.3407
20.00	0.150	0.0130	0.8660	0.0250	0.2152	0.9015	0.7886	34.5319
22.00	0.150	0.0130	0.8660	0.0250	0.2296	0.9587	0.8511	35.5759
2.00	0.150	0.0130	0.9659	0.0250	0.0470	0.1896	0.1508	8.4503
14.00	0.150	0.0130	0.9659	0.0250	0.1632	0.7653	0.5972	30.3143
16.00	0.150	0.0130	0.9659	0.0250	0.1783	0.8371	0.6616	32.1145
18.00	0.150	0.0130	0.9659	0.0250	0.1930	0.9047	0.7201	33.7867
20.00	0.150	0.0130	0.9659	0.0250	0.2074	0.9674	0.7886	34.9886
22.00	0.150	0.0130	0.9659	0.0250	0.2213	1.0281	0.8511	36.0557
2.00	0.150	0.0130	0.9962	0.0250	0.0465	0.1929	0.1508	8.4770
14.00	0.150	0.0130	0.9962	0.0250	0.1615	0.7808	0.5972	30.4130
16.00	0.150	0.0130	0.9962	0.0250	0.1764	0.8548	0.6616	32.2255
18.00	0.150	0.0130	0.9962	0.0250	0.1910	0.9224	0.7201	33.8607
20.00	0.150	0.0130	0.9962	0.0250	0.2052	0.9872	0.7886	35.1151
22.00	0.150	0.0130	0.9962	0.0250	0.2189	1.0500	0.8511	36.2014

FLOW L/S.	DIA. M.	MANN. COEFF	SUPPLY SLOPE (SIN)	DRAIN SLOPE (SIN)	DRAIN FLOW ENTRY DEPTH RATIO H/D.	ENTRY ENERGY M.	NORMAL DEPTH H/D.	PIPE LENGTH T NORMAL DEPTH. L/D.
2.00	0.150	0.0130	0.2588	0.0167	0.0710	0.0906	0.1725	6.5632
14.00	0.150	0.0130	0.2588	0.0167	0.2551	0.3414	0.6978	15.1767
16.00	0.150	0.0130	0.2588	0.0167	0.2800	0.3707	0.7759	16.7734
18.00	0.150	0.0130	0.2588	0.0167	0.3040	0.3987	0.8521	16.1079
20.00	0.150	0.0130	0.2588	0.0167	0.3279	0.4238	0.9272	14.2745
22.00	0.150	0.0130	0.2588	0.0167	0.3508	0.4485	1.0000	15.3387
2.00	0.150	0.0130	0.5000	0.0167	0.0577	0.1296	0.1725	7.1766
14.00	0.150	0.0130	0.5000	0.0167	0.2035	0.5071	0.6978	22.3979
16.00	0.150	0.0130	0.5000	0.0167	0.2228	0.5527	0.7759	18.7341
18.00	0.150	0.0130	0.5000	0.0167	0.2416	0.5952	0.8521	16.8560
20.00	0.150	0.0130	0.5000	0.0167	0.2600	0.6347	0.9272	10.1867
22.00	0.150	0.0130	0.5000	0.0167	0.2781	0.6719	1.0000	17.4717
2.00	0.150	0.0130	0.7070	0.0167	0.0518	0.1579	0.1725	7.4623
14.00	0.150	0.0130	0.7070	0.0167	0.1810	0.6293	0.6978	21.7122
16.00	0.150	0.0130	0.7070	0.0167	0.1981	0.6863	0.7759	19.3127
18.00	0.150	0.0130	0.7070	0.0167	0.2145	0.7413	0.8521	20.8090
20.00	0.150	0.0130	0.7070	0.0167	0.2306	0.7920	0.9272	25.0838
22.00	0.150	0.0130	0.7070	0.0167	0.2463	0.8400	1.0000	17.9951
2.00	0.150	0.0130	0.8660	0.0167	0.0466	0.1777	0.1725	7.6178
14.00	0.150	0.0130	0.8660	0.0167	0.1691	0.7157	0.6978	21.9579
16.00	0.150	0.0130	0.8660	0.0167	0.1849	0.7813	0.7759	19.3695
18.00	0.150	0.0130	0.8660	0.0167	0.2003	0.8430	0.8521	21.8153
20.00	0.150	0.0130	0.8660	0.0167	0.2152	0.9018	0.9272	22.6173
22.00	0.150	0.0130	0.8660	0.0167	0.2296	0.9587	1.0000	17.8947
2.00	0.150	0.0130	0.9659	0.0167	0.0470	0.1896	0.1725	7.6935
14.00	0.150	0.0130	0.9659	0.0167	0.1632	0.7653	0.6978	22.1253
16.00	0.150	0.0130	0.9659	0.0167	0.1783	0.8371	0.7759	19.2514
18.00	0.150	0.0130	0.9659	0.0167	0.1930	0.9047	0.8521	22.1145
20.00	0.150	0.0130	0.9659	0.0167	0.2074	0.9674	0.9272	22.2707
22.00	0.150	0.0130	0.9659	0.0167	0.2213	1.0281	1.0000	17.5454
2.00	0.150	0.0130	0.9962	0.0167	0.0465	0.1929	0.1725	7.7194
14.00	0.150	0.0130	0.9962	0.0167	0.1615	0.7808	0.6978	22.1755
16.00	0.150	0.0130	0.9962	0.0167	0.1764	0.8548	0.7759	19.1852
18.00	0.150	0.0130	0.9962	0.0167	0.1910	0.9224	0.8521	22.1935
20.00	0.150	0.0130	0.9962	0.0167	0.2052	0.9872	0.9272	22.2160
22.00	0.150	0.0130	0.9962	0.0167	0.2189	1.0500	1.0000	17.4507

APPENDIX 2

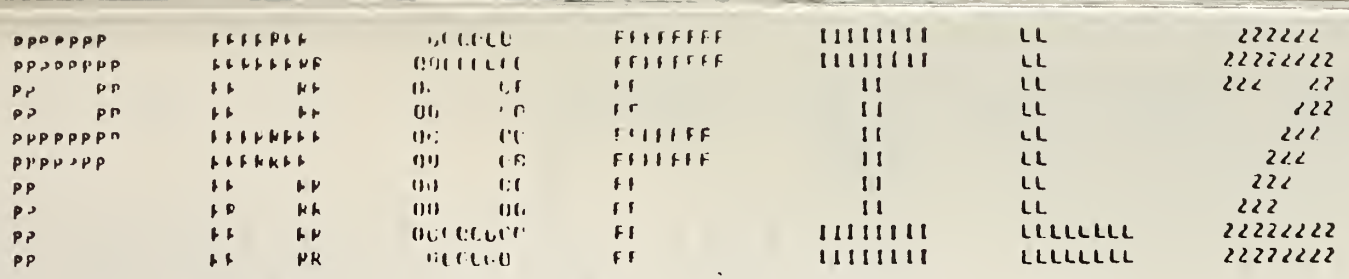
DESCRIPTION OF PROGRAM PROFIL 2

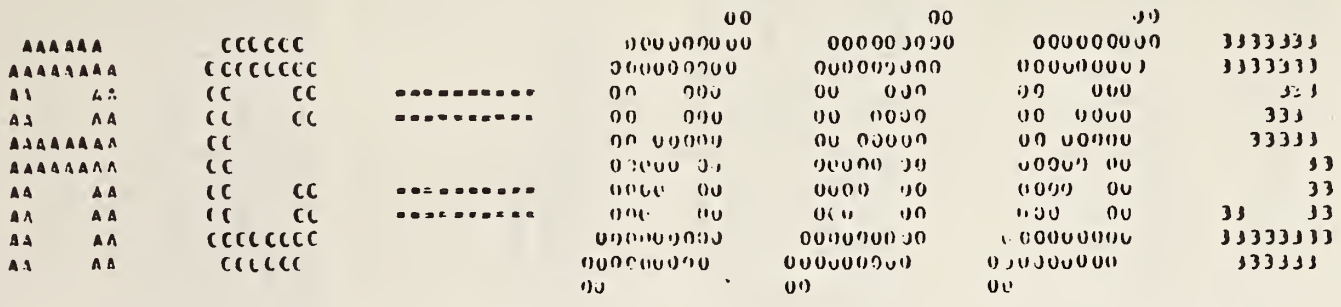
Program PROFIL 2

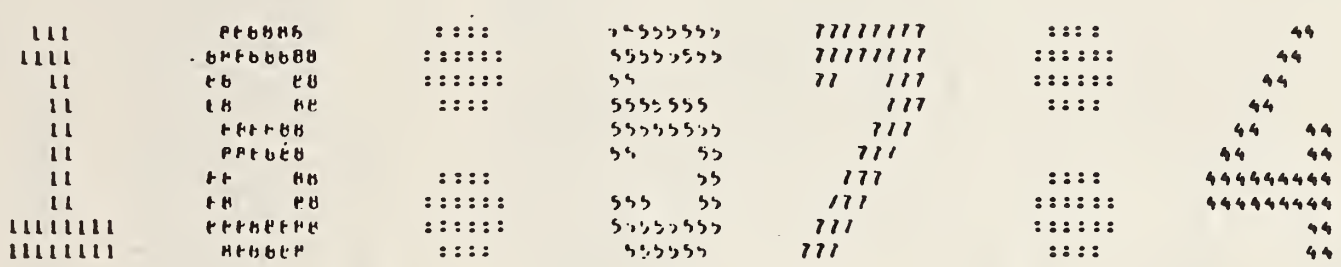
This appendix presents a complete print out of this program together with sample input data. The program was run on the NBS CBT Perkin Elmer 732 computer.

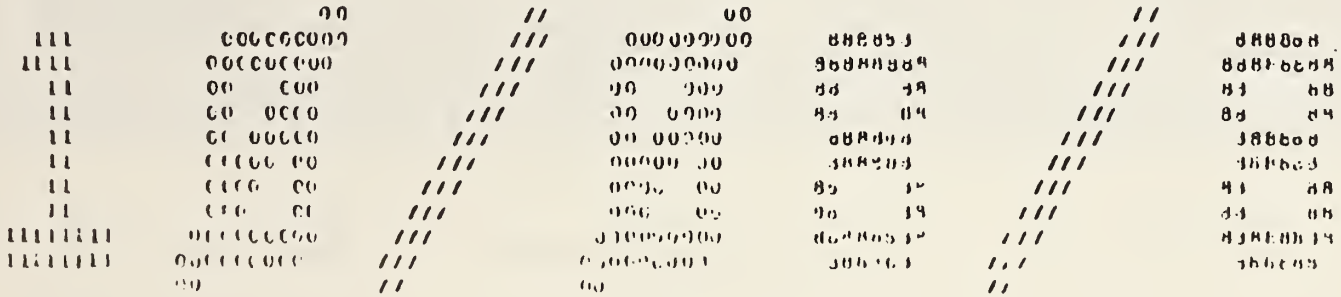
The program accepts data in SI units with the exception of flow rate which is read in liters/second and corrected to m^3/s within the program.

The program is effectively the first section of the hydraulic jump prediction program fully described in reference [1]. For this reason no detailed flow chart is included in this report.









```
$BATCH
C       PROGRAM PROFILE CALCULATES THE WATER SURFACE PROFILE
C       IN SUPERCRITICAL FLOW FROM AN ENTRY CONDITION
C       REPRESENTING TERMINAL CONDITIONS IN A STEEP SUPPLY PIPE
C       TO THE ESTABLISHMENT OF THE NORMAL DEPTH. IT IS TO BE
C       NOTED THAT THIS TRANSITION DOES NOT REQUIRE A HYDRAULIC
C       JUMP AS THE FLOW IS SUPERCRITICAL AT ITS FULLY
C       DEVELOPED DEPTH.
      DIMENSION Y(2,100),F(2,100),IP(6)
      DIMENSION S(2),EN(2,100),DEP(2,100)
      INTEGER SHAPE
      COMMON/CM1/B,G,G,CON,SO,GAM,FPS,FCRIT,HNORM,AREA,PER,FPM,ENERG
      COMMON/CM2/SHAPE
      COMMON/CM3/IZ
      READ(4,702)SHAPE
702   FORMAT(I3)
      READ(4,120)NN,NS,ICON
      READ(4,121)B,SF,DEN
121   FORMAT(3F10.4)
      G=9.81
      IRUN=0
      IZ=0
300   IF(IZ.GT.1)IP(IZ)=IS
      IZ=IZ+1
      IF(IZ.GT.2)IZ=1
      READ(4,100)PL,SO,Q,HCONT,ENZ
       S(IZ)=SO
C     IF ICON=1 THE FLOW ANALYSIS IS BASED ON AN INPUT ENERGY AT
C     ENTRY TO THE MILD SLOPE PIPE, TERM ENZ. SIMILARLY THE LOSS
C     COEFFICIENT AT PIPE ENTRY MAY BE EXPRESSED AS A FACTOR,DEN,
C     VALUE 0 TO 1.0, TO BE MULTIPLIED BY THE ENZ TERM.
C     AS THE ENTRY FLOW DEPTH IS TO BE CALCULATED FROM ENZ*DEN
C     AND NOT BASED ON FLOW CRITICAL DEPTH, THE CONTROL TERM
C     HCONT IS SET TO 1.0. THE OTHER PARAMETERS REFER TO PIPE FLOW
C     RATE AND DIMENSIONS.
100   FORMAT(5F10.4)
      IF(PL.EQ.0.0)GOTO 301
C     PL-PIPE LENGTH  B-WIDTH, SF-MANNING COEFF, SO-SLOPE,
C     Q-FLOWRATE IN L/S TO BE USED IN M**3/S, HCONT-CONTROL DEPTH
C     SET TO ZERO IF CRITICAL DEPTH ASSUMED.
      Q=Q/1000.0
      RHO=1000.0
      CON=SM**2/SO
      GAM=G*RHO
C     PROGRAM CONTROL DATA.
120   FORMAT(3I4)
C     NN-SIZE OF THE DH STEP IN SIMPSONS RULE,NS-NO.
C     STEPS IN DEPTH CALC.,ICON DETERMINES WHETHER ENERGY
C     INPUT OR UPSTREAM SLOPE IS USED, DEN IS THE ENERGY
C     LOSS FACTOR FOR THE PIPE ENTRY,IN EITHER ENTRY CASE.
C     ENZ-INPUT ENERGY TO REPLACE SLOPE IF ICON = 1.
      IF (ICON.EQ.1) GOTO 650
      GOTO 651
650   ENZ=DEN*ENZ
      CALL BOUND(ENZ,G,B,HB)
      IZ=2
      GOTO 18
651   CONTINUE
      IF(HCONT.EQ.1.0) GOTO 17
      GOTO 18
17    ENGD=DEN*ENGD
      CALL BOUND(ENGD,G,1,HB)
```

```
      HCONT=HB
18    CONTINUE
C     DETERMINATION OF CRITICAL AND NORMAL DEPTHS.
C     THIS SECTION CALCULATES THE NORMAL AND CRITICAL DEPTH IN
C     EACH PIPE LENGTH FOR LATER COMPARISON TO THE CONTROL DEPTH
C     INPUT.
C     CALCULATION OF CRITICAL DEPTH.
      UP=B
      DN=0.0
      HC=UP/2.0
7     CONTINUE
      CALL CALC(HC,CL)
      IF(HCRIT)3,4,5
3     DN=HC
      GOTO 6
5     UP=HC
6     HCN=(UP+DN)/2.0
      IF(ABS((HCN-HC)/HC).LE.0.001) GOTO 8
      HC=HCN
      GOTO 7
8     HC=HCN
4     IF(HCONT.EQ.(-0)HCONT=HC
C     CALCULATION OF NORMAL DEPTH.
      UP=B
      DN=0.0
      HN=UP/2.0
9     CONTINUE
      CALL CALC(HN,CL)
      IF(HNORM) 10,11,12
10    DN=HN
      GOTO 13
12    UP=HN
13    HN=(UP+DN)/2.0
      IF(ABS((HNN-HN)/HN).LE.0.001) GOTO 14
      HN=HNN
      GOTO 9
14    HN=HNN
11    CONTINUE
C     THIS SECTION PREPARES FOR THE PROFILE CALCULATIONS
C     BY SORTING FLOWS BASED ON PIPE SLOPE AND THE NORMAL AND
C     CRITICAL DEPTH VALUES.
      IF(HN.LT.HC) GOTO 50
C     MILD SLOPE.
      IF(HCONT.LT.HC) GOTO 45
C     SUBCRITICAL FLOW, HCONT GT. HC.
      SIGN=-1.0
      DH=(HCONT-HN)/FLOAT(NN)
      GOTO 60
C     SUPERCRITICAL FLOW, HCONT LT. HC.
45    SIGN=1.0
      DH=(HC-HCONT)/FLOAT(NN)
      GOTO 60
C     STEEP SLOPE, HN LT HC.
50    IF(HCONT.LE.HC) GOTO 55
C     SUBCRITICAL FLOW, HCONT GT HC.
      SIGN=-1.0
      DH=(HCONT-HC)/FLOAT(NN)
C
      GOTO 60
C     SUPERCRITICAL FLOW, HCONT LT HC.
55    SIGN=1.0
      N2=NN*2
      DH=(HN-HCONT)/FLOAT(N2)
```

```
60      SL=0.0
        IS=1
         IF(IZ.EQ.1) GOTO 947
        H=HCONT
        CALL CALC(F,DL)
        E=ENERG
        FM=FPM
        IF(IZ.GT.1)F(IZ-1,IS)=FM
        IF(IZ.EQ.2)X(1,IS)=0.0
        IF(IZ.GT.1)DEP(IZ-1,IS)=H
        IF(IZ.GT.1)EN(IZ-1,IS)=E
         IF(IZ.EQ.2) GOTO 313
C
C
C
C
C
C
947     CONTINUE
C       THE APPROACH PIPE LENGTH MAY BE IGNORED IF TERMINAL CONDITIONS
C       ARE ASSUMED. THIS SECTION USES THIS OPTION BY CHECKING THE
C       PIPE NUMBER,IZ,AND THE VALUE IF ICON WHICH IS SET TO 2.
        H=HN
        CALL CALC(F,DL)
        ENGO=ENERG
        HENT=HN
        EENT=ENGO
        GOTO 800
313     CONTINUE
C       WATER SURFACE PROFILE CALCULATIONS USING SIMPSONS RULE
C       TO EVALUATE THE INTEGRAL.
        DO 90 I=1,NS,2
        SLO=SL
        IS=IS+1
        H2=HCONT+SICN*DH*FLOAT(I+1)
        H3=HCONT+SICN*FLOAT(I)*DH
        CALL CALC(F,DL)
        CALL CALC(F2,DL2)
        CALL CALC(F3,DL3)
        DX=DH*(DL+DL2+4.0*DL3)/3.0
        SL=SL+DX
        H=H2
        CALL CALC(F,DL)
        E=ENERG
        FM=FPM
         X(1,IS)=SL
         DEP(1,IS)=H
         IF(H.GE.0.975*E) GOTO 999
         IF(H.GE.0.975*HN) GOTO 999
90       CONTINUE
999     CONTINUE
        XFIN=X(1,IS)
        HFIN=HN
        Q=Q*1000.0
        HENT=HENT/B
        HFIN=HFIN/B
        IF(HFIN.GT.0.999) HFIN=1.0
        XFIN=X(1,IS-1)+(0.975*HN-DEP(1,IS-1))*(X(1,IS)-X(1,IS-1))/
     1 (DEP(1,IS)-DEP(1,IS-1))
        XFIN=XFIN/B
        IRUN=IRUN+1
        IF(IRUN.EQ.1) WRITE(3,700)
        IF(Q.NE.0.0)WRITE(3,709)
```

```
709     FORMAT(/10X3
        WRITE(3,701)Q,B,RM,S(1),S(2),MENT,EENT,HFIN,XFIN
701     FORMAT(10X,F6.2,F6.3,3F7.4,3F10.4,F12.4)
700     FORMAT(1H1,////,10X,' FLOW ',' CIA. ',' MANN. ',
     1 ' SUPPLY',' CHAIN ',' DRAIN FLOW',' ENTRY ',
     2' NORMAL ',' PIPE LENGTH TO',/,
     310X,' L/S. ',' M. ',' COEFF ',' SLOPE ',' SLOPE ',
     4' ENTRY DEPTH ENERGY DEPTH NORMAL DEPTH.',
     4 /,29X,' (SIN) (SIN) ',
     5' RATIO H/D. M. H/D. L/D.',///)
        IF(IRUN.EQ.30) IRUN=0
        GOTO 900
901     CONTINUE
        END
        SUBROUTINE BOUND(E,Q,S,HB)
        INTEGER SHAPE
        COMMON/CM2/SHAPE
C       SUBROUTINE BOUND CALCULATES THE ENTRY CONDITION TO THE
C       MILD SLOPE PIPE (IZ=2) BY REFERENCE TO THE ENERGY AT
C       DISCHARGE FROM THE STEEP SLOPE PIPE (IZ=1), OR SIMPLY
C       FROM THE ENERGY INPUT DATA IF THAT MODE IS CHOOSEN
C       BY THE INPUT OF ICON = 1 IN THE INITIAL READ STATEMENTS.
C       PIPE CROSS SECTION IS CONTROLLED BY THE VALUE OF
C       TERM SHAPE, 1=RECTANGULAR OR 2=CIRCULAR, IN THE INPUT.
        G=9.81
        IF(SHAPE.GT.1) GOTO 2
        Y1=0.0
        HB=Q/(B*(2.0*G*E)**0.5)
        DH=HB/200.0
        HX=HB/2.0
        DO 75 I=1,100
        IF(I.GT.1) Y1=Y
        HX=HX+DH
        Y=(Q**2)/(2.0*G)+((B*HX)**2)*(HX-E)
        IF(I.EQ.1)GOTO 75
        IF(Y1.GE.0.0.AND.Y.LE.0.0) GOTO 76
        IF(Y1.LE.0.0.AND.Y.GE.0.0) GOTO 76
75      CONTINUE
76      HB=HX
        GOTO 1
2       CONTINUE
        H=0.0
        EC1=0.0
        DELH=B/200.0
        PI=3.142
        R=B/2.0
3       H=H+DELH
        IF(H.LT.R) THETA=2.0*ATAN(SQRT(H*(B-H))/(R-H))
        IF(H.EQ.R) THETA=PI
        IF(H.GT.R) THETA=PI+2.0*ATAN((H-R)/(SQRT(H*(B-H))))
        AREA=((B**2)/8.0)*(THETA-SIN(THETA))
        EC2=H+(Q**2)/((AREA**2)*2.0*G)
        IF(EC2.LE.E.AND.EC1.GE.E) GOTO 4
        EC1=EC2
        GOTO 3
4       HB=H
1       CONTINUE
        RETURN
        END
        SUBROUTINE CALC(H,DL)
C       SUBROUTINE CALC IS USED THROUGHOUT THE PROGRAM TO
C       DETERMINE THE FLOW-PIPE PARAMETERS SUCH AS FLOW
```

```
C       IN THE BISECTION METHOD CALCULATION OF NORMAL AND
C       CRITICAL DEPTHS IN EACH OF THE PIPE LENGTHS.
C       IN THE CIRCULAR PIPE CROSS SECTION CASE IT ALSO
C       CALCULATES SUBTENDED ANGLE AND THE WATER SURFACE
C       WIDTH AS DEPTH CHANGES.
C       AS IN BOUND AND MAIN PROGRAM THE PIPE SHAPE IS DETERMINED
C       BY THE VALUE OF THE TERM SHAPE INPUT AS DATA.
        INTEGER SHAPE
        COMMON/CM1/B,G,C,CON,SO,GAM,RHO,HCRIT,HNORM,AREA,PER,FPM,ENERG
        COMMON/CM2/SHAPE
        COMMON/CM3/IZ
        IF(SHAPE.GT.1)GOTO 1
        IF(IZ.EQ.3.AND.H.GE.B)H=B
        AREA=H*B
        PER=B+2.0*H
        HCRIT=1.0-(G**2)*B/(G*AREA**3)
        HNORM=1.0-(C**2)*CON/((AREA**3.333)/(PER**1.333))
        DL=HCRIT/(HNORM*SO)
        FPM=(GAM*AREA*H/2.0)+(RHO*G*C/AREA)
        ENERG=H+(Q**2)/((AREA**2)*2.0*G)
        GOTO 2
1       R=B*0.5
        PI=3.142
        IF(IZ.EQ.3.AND.H.GE.R) GOTO 20
        IF(H.LT.R) THETA=2.0*ATAN(SQRT(H*(B-H))/(R/2.0-H))
        IF(H.EQ.R) THETA=PI
        IF(H.GT.R) THETA=PI+2.0*ATAN((H-R/2.0)/(SQRT(H*(B-H))))
        GOTO 22
20      H=B
        THETA=2.0*PI
        AREA=PI*(B/2.0)**2
        PER=PI*B
        XO=B/2.0
        GOTO 21
22      CONTINUE
        AREA=((B**2)/8.0)*(THETA-SIN(THETA))
        PER=B*THETA/2.0
        T=2.0*((H*(B-H))**.5)
        HCRIT=1.0-(G**2.0)*T/(G*AREA**3)
        HNORM=1.0-(C**2.0)*CON/((AREA**3.333)/(PER**1.333))
        DL=HCRIT/(HNORM*SO)
        XO=(2.0/3.0)*(B/2.0)*(3.0*SIN(THETA/2.0)-SIN(3.0*THETA/2.0))
       1/(4.0*(THETA/2.0-0.5*SIN(THETA)))
21      HBAR=XO+H-B/2.0
        FPM=GAM*AREA*HBAR+RHO*Q*C/AREA
        ENERG=H+(Q**2)/((AREA**2)*2.0*G)
2       CONTINUE
        RETURN
        END
$ENTRY
```

Sample data program PROFIL 2.

Line 1. SHAPE, Format I3.
Geometry indicator 2 = circular pipe
∇∇2

Line 2. NN, NS, ICON, Format 3I4
NN - dh interval on depth profile
NS - N° calculation steps, max., Simposn Rule
ICON - 2 assumes terminal conditions in approach pipe
∇∇30∇200∇∇∇2

Line 3. B, RM, DEN, Format 3F10.4
B - pipe diameter, RM - Manning Coeff.,
DEN - entry energy loss coefficient
∇∇∇∇0.1500∇∇∇∇0.0090∇∇∇∇1.0000

Line 4. PL, SO, Q, HCONT, ECZ, Format 5F10.4
PL - pipe length, SO - pipe slope, Q - flow rate
HCONT - control depth indicator, 0 value
indicates upstream critical control,
ENZ - entry energy, zero unless ICON = 1.
∇∇∇∇40.0000∇∇∇∇0.0070∇∇∇∇4.0000∇∇∇∇0.0000∇∇∇∇0.0000

Note, line 4 is approach pipe data.

Line 5. PL, SO, Q, HCONT, ENZ, Format 5F10.4
HCONT = 1 indicates entry depth as control
Line 5 is test pipe data
∇∇∇∇40.0000∇∇∇∇0.0250∇∇∇∇4.0000∇∇∇∇1.0000∇∇∇∇0.0000

Line 6, 7; 8, 9; etc repeat format 4, 5; for all test cases

Last line. PL, SQ, Q, HCONT, ENZ, Format 5F10.4 zero
values terminate run.
∇∇∇∇0.0000∇∇∇∇0.0000∇∇∇∇0.0000∇∇∇∇0.0000∇∇∇∇0.0000

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10. SUPPLEMENTARY NOTES

☐ Document describes a computer program; SF-185, FIPS Software Summary, is attached.

11. ABSTRACT (A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here)

The criteria governing the development of steady partially filled supercritical pipe flow are presented together with the necessary techniques to determine the water surface profile in the pipe entry transition length.

The establishment of full bore flow is predicted for a range of flow rates and pipe design parameters. Based on the water surface profile calculation technique pipe length predictions are presented to avoid the air pressure fluctuations in the drainage system that result from full bore flow establishment.

Tabular data is presented to allow design decisions to be made that link pipe slope, diameter and roughness to the need to avoid full bore flow. A graphical technique is also presented that removes the necessity to interpolate from the tabular data.

The effect of entry geometry loss coefficients is included in the techniques presented.

12. KEY WORDS (Six to twelve entries; alphabetical order; capitalize only proper names; and separate key words by semicolons)

Building drainage; supercritical flow; transition length; vertical stack drain entry.

13. AVAILABILITY

☒ Unlimited

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